THE SCIENTIFIC ENQUIRER:

A MONTHLY MEDIUM FOR THE SUPPLY OF
INFORMATION ON ALL

Scientific Subjects.

EDITED BY

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Our Purpose and Aim.

THE title alone of this new Journal expresses so sufficiently its purpose and aim as to render any further explanation well-nigh superfluous.

Our desire is to afford to the scientific enquirer a medium through which he may not only ask for information on scientific subjects, but, so far as is possible, obtain some kind of answer. We need not say that both the questions and the answers must be made in accordance with the simple rules which will be found at the head of their respective sections.

All our readers are invited to ask questions, and as many as please are requested to send replies; should the Editor himself think fit, he will occasionally make a reply.

In addition to the Query portion, there will be space devoted to short papers or notes of general scientific interest, such as Astronomy, Botany, Chemistry, Entomology, Geology, Microscopy, Zoology, etc. etc., and all such matters as are likely to interest the general reader.

As opportunity offers, short extracts will be made from a great variety of Foreign Journals, and if our correspondents should send us at any time extracts from British or other Journals, they will oblige by giving the name and date of the Journal from which such has been taken.

The Editor will, where practicable, answer all letters addressed to himself in the next issue of the *Scientific Enquirer.* Contributions, for whichever department they may be intended, must in all cases bear the name and address of the writer, not necessarily for publication. They must be written plainly, on one side of the paper only, and for the Editor's special convenience, he would suggest that note-paper (single pages) be the size adopted by the contributors. Of course, any number of pages may be used.

Short Papers and Notes.

Unpleasant Experiences of some supposed Edible Fungi.

SOME time since, I gathered a quantity of the common curled Helvella (*Helvella crispa*) growing among dead leaves under trees on a lawn. Having read that "if stewed slowly and with care, this species will prove very pleasant eating, and will exude a delicious gravy," and that they greatly resemble morels in flavour, I determined to try the experiment, and unfortunately persuaded some ladies, who are intensely sceptical as to the gastronomic qualities of "toad-stools," to cook them as directed. Judge of my consternation when a very unpleasant smell came from the kitchen, and the dish when cooked, instead of being "very pleasant eating," was exceedingly nasty, tasting and smelling like "cart-grease."

The consequence has been that my reputation, which was staked upon this one trial, is gone for ever, and my friends cannot be induced to try any more "toad-stools, not even such delicious ones as the clouded agaric (*Agaricus nebularis*). I hope that others may have had a more pleasant experience in eating helvellas. There could not have been any mistake as to the species, for my fungi corresponded exactly with the figure in Berkeley's "Fungology."

Not long after this disappointment, I was rewarded by a delicious stew made of the clouded agaric, but after tea the servant kept constantly coming into the room where I was reading and taking furtive looks at me.

Annoyed at this, I asked what she meant by it. "To see that you are all right, sir," was the reply.

C. H. WADDELL, Kendal.

Cementing Slides.

In cementing slides, it is well to remember that some substances expand—such as glycerine—and that unless a cement is used which is to a certain extent elastic, the cells would be apt to get cracked. I think gold-size makes the best cement.

V. A. L.

Cleaning Slides.

I.—Make a solution of Hudson's Extract of Soap, immerse the slides, and leave for a few days; the balsam, cement, and everything else will clean off beautifully. It is preferable to using vitriol or other strong acids.

J. W. Groves.

II.—I find the following solution very good for new or old slides and cover-glasses:—Bichromate of Potash, 2 ozs.; Sulphuric Acid, 3 fluid ozs.; Water, 25 fluid ozs. Cover them completely with the brown fluid, rinse under a tap, and stand on edge on several thicknesses of blotting-paper. Before mounting on them, the dust should be brushed off with a camel's-hair brush. For new covers, place a few in a wide-mouthed bottle, cover with the solution, shake often so as to separate them. After three or four hours, pour off acid solution, and wash the covers in a bottle with water, pouring on and off until the water is colourless. When wanted, a cover can be taken out of the bottle with a pair of forceps and wiped dry with a linen rag. This plan is useful for even the thinnest covers. V. A. L.

On the Orange Insects.

(Extracted from *Chambers's Journal.*)

When a dish of oranges is seen on the table at dessert, the fact is hardly realised that in all probability their surface is the *habitat* of an insect of the Coccus family. This tiny creature is found on the orange skin in every stage of transformation, from the egg to the perfect insect, during the winter months, instead of remaining dormant in the cold weather, as is the case with most of this insect tribe. It would hardly be possible to find a St. Michael's or Tangierin orange that had not hundreds of these little creatures, in various stages of development, on its surface. Lemons, too, are frequently covered. Upon inspection, the skin of an orange will be found to be dotted over with brownish-scarlet spots of various sizes. These specks can easily be removed with a needle, and when placed under a microscope an interesting scene is presented, consisting of a large number of eggs, which are oval, white bodies, standing on end, like little bags of flour, some of the inhabitants of which may very probably be seen in the process of

emerging from the opened end of the egg. The female insect, upon leaving the egg, has six legs, two long hair-like appendages, and no wings ; it thrusts its sucker into the orange, in order to obtain nourishment, and never moves again, passing through the various stages of development until it lays its eggs and dies. In the case of the male insect, the chrysalis, after a short period, opens and the insect flies off. The male is supplied with wings twice the length of its body, and each of the legs has hook-like projections. It has four eyes and two antennæ, and is so tiny that it cannot be seen flying. From some parts of Spain, oranges come to us having their rind covered with a coccus of quite a different type. The surface of oranges, indeed, affords the possessor of a microscope an infinite amount of interest and amusement.

M. A. HENTY.

Mounting Tongues of Flies.

Flies may be made to protrude their tongues by dropping them into spirit of wine. They die with the tongue well extended, and the death is probably as humane as any other.

A. E.

Rare Micro. Fungi.

I have been fortunate in finding two very rare micro. fungi. One is *Æcidium zonale*, a cluster-cup on the leaves of *Inula dysenterica*. This has been found once before in Britain, at King's Lynn. The other is *Ramularia Lapsanæ*, on *Lapsana communis*, which has never been found before in Britain, though probably it has been overlooked. The above fungi were found at Totland's Bay, Isle of Wight, in June, 1885.

H. PUREFOY FITZGERALD, M.C.S.

A Simple Cell for Fluid Mounts.

I have lately been using a cell for fluid mounts, which I think will answer, and as it is rather a simple affair, perhaps others might like to try it.

Cut cardboard rings (I use gun punches of different sizes for this purpose); the ordinary stiff post-card will be found the most convenient thickness, and place them in patent knotting for a day until thoroughly saturated; then hang them on a cotton line, separating so that they do not touch, in a warm place until thoroughly dry. They can then be put away till wanted for use.

To fasten these cells to the glass slips, I make a good ring of gold-size, and press the cell well down into it, then use moderate heat, and put by until cool; the ring should then be securely fastened to the slip. Now examine well to see if air appears under the cell; if so, place more gold-size round, and heat again. After the ring is firmly fastened, I cover it with a mixture of gold-size and oxide of zinc, placing a circle of this cement on the inside edge of the ring. This is a great safeguard against air-bubbles.

I have had some objects in glycerine fluid in these cells since the beginning of August last, and there is nothing the matter with them yet.

The gold-size and oxide of zinc make a capital cement for fluid mounts; it is very safe, and dries well.

M. FARHALL,
7, Lorna Road, West Brighton.

Notes on Mounting Micro. Slides.

Never use asphalt for cell-making or fixing cover-glasses. It is certain, sooner or later (generally sooner), to give way and ruin the slide.

Fluid Mounts (Glycerine, Alcohol and Water, Carbolic Acid Water, etc.)—Make, with the turn-table, a circle of gold-size in the centre of the slide a little smaller than the cover-glass you intend to use. In a couple of minutes or so this will be set, but still sticky. Fill this circle with the mounting fluid—it will not run over the ring—arrange the object upon the slide. Now take the cover-glass between finger and thumb, coat the under edge all round with gold-size, place it upon the surface of the fluid on the slide, and carefully press down. The excess of fluid being thus squeezed out, the gold-size on cover and slide will adhere; wipe away all moisture with a soft handkerchief (if glycerine is used in mounting, it is best to wash it away with a stream of water first). Place the slide again upon the

turn-table, run a coat of gold-size round edge of the cover-glass, and set aside to dry. In this way, with care, a perfectly secure fluid mount may be made, which, with fair usage, will never leak. All wet mounts, however, should occasionally be looked at, and receive a fresh coat of gold-size round the cover.

JOHN DEANS, M.R.C.S., Bournemouth.

Tobacco Plant.

I have had a beautiful plant of *Nicotiana affinis* (Tobacco) in my garden this summer, which I put out in the spring, and, as I imagine, it grew to a most unusual size, being a little over four feet high, very bushy, and having at one time many more than 100 blossoms scenting the air in the evening, and being very attractive to moths. On one occasion I saw four large Convolvulus Hawk Moths (*Sphinx convolvuli*) flitting about it, never settling, but remaining stationary on the wing, while their long tongues were thrust to the bottom of the flowers. It was a most beautiful sight.

I caught one of these moths, and have the head now in fluid, from which I hope to make some slides for the microscope.

M. FARHALL, West Brighton.

Desperate Battle with Rats.

A correspondent sends us the following cutting (presumably from the *Animal World*):—

"E. S. Barden, a well-known farmer of the town of Candor, Broome County, entered a pig-sty on his farm recently to make some needed repairs. At the first stroke of his hammer two large rats ran out of a hole in the floor and attacked Mr. Barden. He kicked at one of the rodents and it set up a loud squealing. In response to the cry, rats swarmed into the sty from holes and crevices on every side. They sprang upon him and endeavoured to reach his face. Barden called his dog, a large St. Bernard, which came promptly to the spot and leaped in among the little animals. The rats turned their attention to the dog, and gave Barden an opportunity to leave the sty. Arming himself with a club, he returned to assist the dog, which had killed

a number of rats. The survivors, however, fought as furiously as ever. For ten minutes the battle raged, and then, only half-a-dozen rats being left, they retreated. The floor of the sty was covered with dead rats. The dog was red with blood from the savage bites of the rats, which were of unusual size, some of them measuring nearly a foot in length. They were of a deep-grey colour, and are believed to be a colony of the rats which have been annoying the farmers of Bradford and Susquehanna counties, Pa., for some months. None like them have been seen anywhere else in the neighbourhood."—*Utica Observer.*

The editor of the *Animal World* adds:—

"This story reminds us of one told by Lord Brougham in his conversations with Lord Althorp on Instinct, in which a man was attacked and nearly destroyed by scores of rats, who came out of their holes in a river-bank on a signal being given by a rat he had wounded with a whip while passing over a plank bridge."

Curious Lightning Accident.

The *Scientific American* contains an account of a curious accident which recently happened at Camilla, New York. It appears that five horses were standing with their necks over a wire fence, when suddenly a flash of lightning struck the fence at a distance of 1,000 feet from the animals. The current traversed the wire, and went to earth through the horses, killing them instantly.

A November Star-Shower.

There occurred on the evening of the 27th November last a shower of Meteors, or Shooting Stars, that far exceeded the great display of 13—14th November, 1866, of which a brief note may be worth a place in your Journal.

My attention was directed at 4.40 p.m. to what at the first glance I took to be sheet-lightning, but which a moment's observation showed me was an extraordinary number of meteors flashing across the sky, some faint, others far brighter than Venus ever appears to be, and many of these latter leaving a trail of light; as a countryman who spoke about them to me expressed it, "You could not look at a star but it ran away." I saw the great shower

of 1866 under most favourable circumstances, but this one of 1885 was much finer. I and a member of my family whom I called to behold the magnificent spectacle tried to count them, and we noticed their number to be more than seventy per minute, which is considerably above the total per minute of the shower of nineteen years ago. We watched them for an hour, when the sky became overcast, and the rest of the night was occupied with a heavy downpour of rain. What added to the grandeur of the sight was that all the meteors seemed to proceed or diverge from the same point, which was situated a little below Cassiopeia's Chair. From that spot, the shooting-stars radiated in all directions, and as the precise locality was in the north-east and not too much overhead, it afforded the grandest astronomical sight it has ever fallen to my lot to witness.

The occurrence opens up a new field for our star-gazers and calculators, as the 27th November is not one of the dates set down for the recurrence of the November star-showers. The question arises, Has the orbit of the earth got across another part of the band of meteors which astronomers tell us it cuts through each year about the 13th November? I should mention that when the misty clouds on the 27th November, 1885, began to gather, and the stars were lost to view, a great many of the meteors were visible for some time, as they sped hither and thither on their mysterious paths.

H. W. LETT, M.A.,
Ardmore Glebe, Lurgan, Ireland.

Chironomus Prasinus.

While dissecting a specimen of the fresh-water mollusc, *Limnæa peregra*, var. *ovata*, I suddenly came across the larva of the above insect living parasitically (?) in the body. It was comfortably settled below the mantle. Has it ever been found in a like position before? Had it found its way there accidentally or purposely?

H. PUREFOY FITZGERALD,
North Hall, Basingstoke.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed before beginning their reply.

1.—Mounting the Antheridia and Archegonia of Ferns. —Will some expert kindly give *detailed instructions* for the preparation and mounting of the Antheridia and Archegonia from the Prothallus of Ferns, so as to be able to view their internal structure, as given in "Sach's" and other text-books?

J. W. G.

2.—Adelges Fagi.—Can anyone give me any information about an insect named *Adelges Fagi?* It forms a white, powdery mass on the stems of beech-trees, and I believe injures the trees very considerably. It resembles a kind of Coccus which attacks pear-trees. Any notes on this creature would be of interest.

H. P. FitzGerald, M.C.S.

3.—Mounting Acari.—I shall be glad of any information as to the best methods of preparing and mounting the smaller and more delicate kinds of Acari, as *Tetranychi*, *Tyroglyphidæ*, *Sarcoptidæ*, etc.

J. B. J.

4.—Mounting Algæ.—I am in want of a suitable medium for mounting such delicate and evanescent freshwater algæ as *Volvox*, *Pandorina*, and *Anabæna*, all that I have hitherto tried having failed to preserve these beautiful organisms, my mounts of them becoming spoiled in a few days. Slides of *Volvox* are to be found in many cabinets, and I hope some of your readers may tell me through your Journal the way to do it. I have never seen a mounted specimen of *Anabæna*, a most interesting but little-known plant, and residing on the shores of Lough Neagh, wherein

at certain seasons it abounds; I should like to know how to prepare it for future use with the microscope. In the *Annals of Natural History*, Vol. V., there is a full account of the *Anabæna*, and its occurrence in a lake at Ballydrain, co. Antrim, by the late Wm. Thompson, of Belfast, which Dr. M. C. Cooke considered worthy of quoting from at considerable length in his "Fresh-Water Algæ," p. 235. When secured and dried on paper, it makes merely a slight green stain, which is equally unsatisfactory for botanical purposes, as a specimen of *Volvox* would be if mounted in the same manner. I may mention that the lake which gives its name to the little town of Glasslough, in co. Monaghan, also abounds with the same cryptogam, and derives its appellation (which in the Irish language means "Green lake") from the water being turned green in the autumn by this minute algæ.

H. W. LETT.

5.—**Hairs of the Mole.**—Can a reason be given why the hairs taken from the face of the mole (*Talpa Europæa*) polarise, whilst those taken from the body do not? Also, does the same peculiarity exist in the hairs of other animals?

J. B. B.

6.—**Foreign Lepidoptera.**—A friend abroad has sent me a small parcel of butterflies; the wings are all closed as when at rest. Will some one tell me how to open and set them, so that they may be arranged in a cabinet?

GEO. WHITE.

7.—**Yeast.**—I am desirous of obtaining some practical information respecting the microscopical examination of Yeast. Will some of our readers tell me what they know on the subject?

YOUNG CHEMIST.

8.—**Mites found on Æcidium.**—While examining the Bastard Toad-flax Cluster-Cup, *Æcidium thesii*, a short time ago, I came upon several mites living in and on the fungi. In some places the cups had been completely devoured. Would anyone kindly name the insect for me if I forwarded a specimen? It is quite new to me.

H. PUREFOY FITZGERALD,
North Hall, Basingstoke.

9.—The Growth of Organisms under the Influence of Electricity.—Will some one kindly give a *full* account of Andrew Crosse's experiments on the growth of organisms in various media placed under the influence of electricity? "Crosse's Electrical Mites" I think they were called in derision. An extract from his original papers would be the best answer. J. W. G.

10.—Weevils.—What is the best and most satisfactory medium in which to mount Weevils, balsam having been used up to the present time? V. A. L.

11.—Black Varnish.—There was a black varnish which seems to have been used by some of the older workers in microscopy, and was not affected by the usual solvents—alcohol, benzole, acetic acid, or potash. Can any readers inform me of what ingredients it was composed? V. A. L.

12.—Remounting Slides.—I shall be glad if some one will tell me of a good method of unmounting and remounting damaged slides. S. R. B.

13.—Cosmoline.—This is a valuable medium for mounting Starches; it is also permanent. I believe it is an American preparation, and shall be glad to learn of what it is composed. V. A. L.

14.—Stratena.—Is another compound largely used by American preparers. Can anyone tell me what it is, or of what it is composed? V. A. L.

15.—White Corpuscles of the Blood. — Will anyone kindly give me some information how to observe the amœba-like movement of white blood-corpuscles? I have tried putting a drop of blood under a thin covering glass, and keeping it warm by means of a hot-water plate on the stage of the microscope, but without any success at present. A. E.

16.—Double-Staining Botanical Preparations.—What is a good way of double-staining botanical preparations which exhibit xylem and phloem so as to show a clear differentiation? A. D.

17.—Mounting Chemical Crystals.—I shall be glad to hear of a good method of Mounting Chemical Crystals.

V. A. L.

18.—Beetles on Sunflowers.—During the last summer, upon the fully-expanded blossoms of the Sunflower, I observed vast numbers of a minute black beetle, of which I enclose a specimen.* They would appear to have been active agents in the fertilisation of the stigmas, for as they crawled from floret to floret all over the disc, their bodies became so thickly covered with the adhering pollen grains, that they seemed like moving yellow balls. The pollen of the Sunflower being echinate and slightly viscid, readily adheres even to the smooth surface of the elytra of these beetles. I did not find any upon the unexpanded florets, nor upon the withered flowers, neither have I seen them upon any other flower. Perhaps some correspondent will kindly give me the name of this beetle, and state if it is peculiar to the Sunflower. I may, perhaps, be asking a very simple question, but I am not a coleopterist, and my ignorance must be my excuse. J. W. FISHER, Ealing.

19.—Volvox globator.—I have often searched for this plant in ponds and streams, but always in vain. Is it widely distributed, as the text-books would lead one to suppose, and is it to be found in winter as well as in summer? Any information as to its haunts would be very welcome. C. H. WADDELL, Kendal.

20.—Spiders.—Will anyone recommend a good book on Spiders, not too expensive? A. E.

21.—Pine Woods *v.* Raspberry Canes.—I have heard it stated, that when Pine Woods are cut down, the raspberry cane is sure to appear; is this a fact? And if so, why? M. A. HENTY.

The Editor has personal knowledge of an instance where raspberry canes grow and flourish in luxuriance amongst a forest of firs, showing that the removal of the trees is not necessary to the existence of the raspberry. He feels it right to add, however, that in the case cited the raspberry appeared to be of the cultivated kind, but how they came to grow he could not ascertain.

* The Beetle sent is *Melegethes Æneus.—Editor.*

Extracts from Foreign Journals.

AN AFFECTIONATE MOTHER SPIDER.

THE *Clubiones* are minute, greyish-yellow spiders, with a dark-brown stripe along their back, which build their nests among growing oats, generally using two or three stalks. M. Ernest Menault, a French naturalist, looked into one of their nests and found there a great number of little eggs in various stages of development. The mother-spider was frightened and much excited on observing his proceedings, and endeavoured vainly to collect her treasures again. From another nest M. Menault tore away the protecting web, but the diligent mother soon set herself to work spinning a patch to cover exactly the breach he had made. He repeated the experiment several times, and the spider came as often to repair the mischief. Another spider, the *Lycosa*, gathers her eggs, as soon as they are laid, into a little ball, which she then wraps with a thin but compact and solid covering of silky tissue. This ball, stuck to her web, she drags after her wherever she goes. When pursued, she runs as quickly as the weight of the egg-ball will let her, but, if any attempt be made to seize the cocoon, she stops at once and tries to get it back, when she shows considerable courage and fighting capacity. If the cocoon is destroyed, the *lycosa* will retire into a corner, and in a short time die. When the eggs are hatched, the mother-spider takes her young upon her back, and has them always with her. "It is impossible," says M. Menault, "to behold without emotion this little creature, naturally so quick and jerky in all her movements, acquire a motion so much gentler when carrying her treasures. She carefully avoids all dangers, only attacks easily-won prey, and abandons all chance of obtaining anything the capture of which would necessitate a combat that might cause her to drop the young ones, which press and move by hundreds round her body." Bonnet tells of a *Lycosa* whose egg-bag was captured by an ant-lion, which nevertheless refused to leave it, preferring to be swallowed up and share the fate of her eggs. When

taken away by force, she persisted in returning to the scene of danger.—*Popular Science Monthly.*

THE PYROPHORE.

AT a recent meeting of the Academy of Sciences, at Paris, a plate half filled with water, in which were half-a-dozen insects about an inch in length, which shone like diamonds, although the room was filled with sunshine, was passed around among the members. These insects had been brought from Mexico, where they are to be found in the forests. The name of the insect is the Pyrophore; and, as none had ever been seen before in Europe, they created quite a sensation. The light resembles that of a glow-worm or a fire-fly, although as much more brilliant and intense as an electric lamp surpasses a wax taper in its power of illumination. When the light begins to fade, it can be made as brilliant as before by shaking the insect, or dipping it in water. It is said the Indians of Mexico use them for a light at night, as a few will suffice to illuminate an entire room. When they are walking at night, they put one on each foot, so that they can be sure of their way, and also that they do not step upon any venomous snake or reptile, with which the tropical forests abound. The Mexican ladies buy them from the Indians, and enclose them in a transparent bag, which they wear in their hair or at the neck. The effect is very beautiful, especially when several are worn; and, as the Indians sell them for a few cents. a dozen, they are within the reach of every fair one. They are fed on sugar-cane, and, if well taken care of, will live a long time. One placed upon a page will enable it to be read with ease in the darkest night.—*The Kansas City Review.*

HIGH INDEX MOUNTING FLUID.

IT will be remembered that a year ago, at Rochester, Prof. Hamilton Smith announced that he had discovered a mounting fluid of an index of refraction higher than any hitherto known or used. He declined at that time to make public the formula for this fluid, giving no explanation of

his motives for so unusual a proceeding. His friends, of course, knew these reasons, and all who knew him felt certain that they were good ones. His motives were, however, questioned abroad, and he was sharply taken to task for a proceeding so foreign to the genius and method of pure science—the intimation being that he had kept his discovery a secret in order to make money out of it. At the Cleveland meeting, Professor Smith announced that having experimented further with his fluid, and given it time to display its bad qualities if it had any—having, in fact, perfected his discovery, he was ready to give it to the world. He made the explanation (which was altogether unnecessary to those who know him) that he had refrained from speaking sooner, simply because he feared announcing a worthless and incomplete discovery. The following is the formula in question :—

"In two (2) fluid drams of glycerine-jelly, made in the usual way, dissolve in the cold, ten (10) drams of chemically pure stannous chloride. When solution is complete, bring to a boil for a few minutes and filter while hot."

It is a curious fact that the glycerine-jelly will dissolve the great quantity of tin salt mentioned. The fluid must be used hot. This may be done by simply heating the slide at the time of mounting, or the fluid may be heated in mass, as with old dry balsam. It has a refractive index (approximately) of 2·40. The colour is about that of old yellow balsam. Diatoms mounted in it show up with wonderful clearness.—*The St. Louis Medical and Surgical Journal.*

PARASITISM AMONG MARINE ANIMALS.

By Ralph S. Tarr.

It is a curious fact that nearly all well-defended marine animals are either brilliantly coloured or otherwise attractive, as in the case of the sea-anemone, jelly-fish, and tropical shells and crabs. Those with little or no defence are generally inconspicuous, or resemble surrounding objects. This may be explained by supposing that by being inconspicuous they easily escape the notice of their enemies. Brilliant, well-defended animals have little fear of enemies,

and by their bright colours attract curious animals within reach of their deadly powers.

Many a fish in the sea instinctively avoids the deadly power hidden behind the brilliantly phosphorescent jelly-fishes. This protective light has saved the jelly-fish much trouble, and is a great aid to it in its struggle for existence among the multitudes of surface animals. Through some curious freak in evolution, an entirely inoffensive cluster of animals, devoid of any protective power, has gained the use of this phosphorescent light, and, by imitating the dangerous jelly-fishes in this respect, sails about the surface, inspiring terror among surface animals that could easily devour them. This cluster of animals is *Pyrosoma*. In the masses of floating seaweed in the Gulf Stream, there are vast numbers of tiny fishes attired in the colour of the floating weed, and that certainly gain protection thereby.

The lump-fish has a sucker on its body by which it can attach itself to some fish of a similar colour, and go freely about, entirely free from danger. This is, no doubt, one way in which parasitism originated. At first an animal attached itself, for protection, to another having the same colour; the next step was to burrow into the animal, and extract its juices. There is a very curious fish that burrows in the side of another, leaving only a small opening, out of which it can project its head and take food. Beyond this it does no harm to the fish. A curious case of parasitism is noticed in *Pennella*, a copepod which burrows into the side of a sword-fish, and has upon its external stem a number of a peculiar species of barnacle, which in its turn has become parasitic.

The sting of the jelly-fish is deadly to nearly every animal of limited size; yet there is a small fish that habitually lives beneath the bell of the jelly-fish, in the midst of flying lasso-cells without being injured. It manages to pick up a very good living from the crumbs left by the jelly-fish. What benefit it is to its host is hard to understand; but it is usually true, in such cases, that some service is returned. The habit of eating at the same table, or commensalism, is seen in many cases, that of the oyster-crab being a very good example. This crab lives within the oyster without offering harm, although it could easily destroy the oyster; but it is satisfied with what it gets, and leaves its friend alone. That such deadly powers as those

possessed by jelly-fishes should have no effect, strange though it may seem, is hardly more wonderful than the power of resisting digestive fluids. In the stomach of a deep-sea sea-anemone a brightly-coloured annelid is often found, in the digestive cavity. Whenever the anemone catches a fish, the annelid shares the meal without any injury to the anemone. Unlike intestinal worms, they are never numerous enough to be of any injury to their host.

This habit of one animal being dependent upon another for its existence receives a curious development in the case of deep-sea hermit-crabs and the sandy sea-anemones, of which *Epizoanthus* is an example. After the free-swimming stage, the anemone settles down upon the back of a shell inhabited by a hermit-crab, and begins to grow around the shell until it has entirely surrounded it, leaving only the entrance clear. The shell is eventually absorbed; and as the hermit grows, the anemone grows to accommodate him, so that he does not have to seek after a new shell. Thus the hermit is furnished with an accommodating, comfortable, and transportable house; but, in return, the hermit transports the sea-anemone from place to place, and keeps it upright. This is a curious case of division of labour among the lower animals.

There is a wide field for the study of the effects of hereditary instinct and evolutionary changes, as exhibited in the cases mentioned. Indeed, it would seem as if the best field for the evolutionist lay among the most degenerate types of an order, viz., parasites; for in their embryonic changes they pass through the higher stages of the past on their way to their present degeneration.—*Science.*

STRONG CEMENTS.

For cementing brass cells to glass slides.

1.—Carbonate of lead, ½ oz.; red oxide of lead, ½ oz.; litharge, 1½ oz. Grind thoroughly together in a mortar. Stir some of this into enough gold-size to make it work stiffly. If too much adheres to the work, turn it off on the turn-table when a little set.

2.—Best quality gum arabic, dissolve in cider vinegar;

add a little sugar. A very strong cement, but have not tested it for durability.—*The Microscopical Bulletin.*

We extract the following from the "St. Louis Medical and Surgical Journal" for December; our readers will doubtless be pleased to know what good opinions our American friends have of us.

"*The Journal of Microscopy and Natural Science.*—In looking at this English quarterly and comparing it with our American publications, one of the many striking remarks of Governor Cox, made at the Cleveland meeting, involuntarily springs into memory. Holding up a copy of some Journal which contained a most beautifully executed engraving of a micro-photograph of diatoms, he said: 'I would rather have *one* such engraving in our proceedings, than a bookful of the ordinary wood cuts with which we have to content ourselves.' Whatever be the merits (and they are many and great) of our own Journals, it is not to be denied that, in this particular at least, we are far behind our English relatives. The four numbers of the Journal whose name heads this article, contain 23 full-page illustrations, each of them of a high degree of merit, besides descriptive matter equally valuable, beautifully printed on first-class paper. To those who desire a first-class foreign quarterly (though anything English scarcely seems foreign to Americans) we most sincerely recommend the *Journal of Microscopy*. Mr. Alfred Allen, the editor, is also the Hon. Secretary of the Postal Microscopical Society, of which the *Journal* is the official organ. With the new year he commences the publication of the *Scientific Enquirer*, which is to be a monthly supplement to the *Journal*, the main features of which are to be questions on all subjects relating to any branch of natural Science, and answers thereto by subscribers, contributions on all points of interest to students of natural history, and extracts from recent publications relating to these subjects."

Correspondence.

The Editor does not hold himself responsible for the opinions or statements of Correspondents.

To the Editor of the "Scientific Enquirer."

SIR,—

I am delighted to know that the new Journal is to be

published shortly, and I hope Photography will find a place amongst the regular subjects. I could answer many questions, but there are many more that I shall be glad to ask. If you could give us a series of short papers on Photo-Micrography, I think many readers would appreciate them.

PHOTO.

[The above suggestion shall have our careful consideration, and in the meantime we shall be glad to hear from any friend willing to furnish such a series of papers as that asked for.—*Editor.*]

Answers to Correspondents, &c.

All contributions SHOULD reach us by the 10th of the month, and cannot be inserted unless we receive them before the 14th.

The Editor hopes that the general appearance of the Second number of the *Scientific Enquirer* will be superior to the present issue; he was ill and unable to leave his room the whole time that it has been in the printer's hands.

A. W. G.—Your contribution came much too late for insertion in the present number. Please experiment further, and let us hear from you again.

M. A. H.—We had gone to press before your query arrived.

Sale and Exchange Column.

All Exchange Notices are inserted free; for Notices of Books or Scientific Instruments or Accessories offered for sale, a charge of 4d. for the first 12 words and 1d. for every succeeding 3 words will be made.

Micro. Slides.—Will send in exchange for two insect mounts. One each of Hairs of Mole taken from the body and face; the latter for Polariscope.—J. B. Bessell, Sidney Villa, Fremantle Square, Bristol.

Wanted, Hypnums striatulum and *pumilum* for *H. confervoides* and *P. curvicollum.*—Rev. C. H. Waddell, Kendal.

Wanted, a few of the commonest Elvellacei or Sphæriacei (named) for Common Mosses or Hepaticæ.—Rev. C. H. Waddell, Kendal.

Foraminiferous Sand in exchange for other microscopic object.—H. Purefoy FitzGerald, North Hall, Basingstoke.

Foraminiferous Material dredged in Belfast Lough at seven and twelve fathoms, and Diatomaceous Clay from four localities in North of Ireland, to exchange for micro. slides of Foraminifera and Diatoms; lists desired.—Rev. H. W. Lett, Aghaderg Glebe, Loughbrickland, Ireland.

Mosses from the Mourne Mountains, co. Down, to exchange for other Mosses or Algæ.—Rev. H. W. Lett, Aghaderg Glebe, Loughbrickland, Ireland.

Wanted, Mites (mounted or in spirit) in exchange for Mounted Diatoms or other slides.—J. B. J., 145, Highbury New Park, London, N.

Wanted, Members for the Scientific Circulating Magazine Society, which offers the choice of Three Parcels of Magazines for perusal every month.—Address T. F. Uttley, 17, Brazennose Street, Manchester.

Some vertical and transverse Vegetable Sections, double-stained, to exchange for other well-mounted slides. —Rev. H. W. Lett, Aghaderg Glebe, Loughbrickland, Ireland.

Scales of the Russian fish, *Sudak,* one of the Percidæ, from Sandra, carefully mounted as a micro. slide; also, Scales of some other uncommon fishes, to exchange for good slides.—Rev. H. W. Lett, Aghaderg Glebe, Loughbrickland, Ireland.

Micro. Fungi for exchange.—Send lists to H. Purefoy FitzGerald, M.C.S., North Hall, Basingstoke.

Microscopic Slides for exchange, chiefly Micro. Fungi, including many rare ones.—H. Purefoy Fitzgerald, M.C.S., North Hall, Basingstoke.

For Slide of Marine Diatoms from Island of Fur Jutland, Sicily, send a good mount of Foraminifera.—A. W. Griffin, 4, Saville Row, Bath.

The Scientific Enquirer.

MARCH, 1886.

Section-Cutting.*

BY T. J. BURHILL.

BOTANISTS as a whole seem to be far behind the zoologists in the matter of microscopical technique, especially in the preparation of material. Witness the literature upon injecting, staining, hardening, imbedding, infiltrating, fixing, cutting, handling, clearing—nearly all of it directly for, or copied from, the animal histologist.

No doubt this comes about naturally enough. In the first place animal tissues require a greater diversity of treatment, and to reach the highest results he who works especially upon them must have resources at command little dreamed of by those whose attention has been exclusively occupied with vegetable preparations. Then those who have earnestly worked upon the minute structure of plants are outnumbered many times by the skilful and intensely devoted animal histologist. The very fact that man's body is animal rather than plant, stimulates investigation on the former instead of the latter side.

But however it may be accounted for, botanists and vegetable physiologists, with only exceptions here and there, are much disposed to remain content with the early methods and processes which zoologists (perhaps zootomists is the word) now consider primitive and superseded. For myself I cannot help feeling that I shall gain much by following, where I cannot make better headway for my special purposes by special methods, the lead of my brothers, the animal histologists. Fixing my thought now upon simple work for the student botanical laboratory, I restrict myself to my theme. Nothing new is offered. What follows is simply some account of results from personal experience as student and instructor.

The first requisite for good section cutting is an *edge*. In a very large number of instances sections for microscopical study cannot be made too thin. Nothing but the keenest and smooth-

* From the "Botanical Gazette," Indianopolis.

est edge will make the thinnest shavings. Among common and usually available articles a good razor furnishes the best edge. The form of the blade is also best—that is, some razors more nearly meet the requirements, so far as form of blade is concerned, than any other common knife. The requisites in a razor for this purpose may be put down as follows: (1) The material must be the best steel, suitably tempered; (2) the edge should be straight from toe to heel and free from "wind" and wabbles; (3) the blade should be of good width, the back firm and heavy and so shaped that in the process of honing the edge will remain straight; (4) both surfaces should be moderately hollow ground, the upper one by preference the most, but neither so much as to make the edge portion sensibly flexible; (5) the upper surface at least should be perfectly polished and free from engraving of any kind. Such razors, or nearly such, can be found in the usual markets and at reasonable cost; the highest priced ones are not commonly the best for our use.

For sharpening, the best razor-hone should be used. This latter must be perfectly level and free from gritty granules, and the blade must be held scrupulously flat. The best edge is secured by turning the razor at every stroke, after the usual manner, provided each stroke is accurate enough to always rest edge and back upon the stone. After honing, until a perfectly true and keen edge is secured, finish upon a leather strop. The latter must be frequently used, but the usual artificial hones should be avoided.

Generally the operator will have to keep his own razor in order, and he cannot be too careful about it. It will not do to trust the skill of the common barber in sharpening. Better study his own needs and then acquire the ability to meet them. An examination of the edge (held toward the light) with a magnifier will be instructive. The sharpened razor should never be used for anything besides cutting the thin sections. All preliminary whittling is to be done with another knife.

Having a proper *edge*, the next thing to be here considered is the manner of holding the object to be cut. For some purposes this can be sufficiently well done in the fingers, either by itself or between such substances as pith, cork, etc.; but in the better work contemplated in this description some form of a microtome is essential. Some persons become very expert by the free hand method, and all will do well to practice it at times, but all ought also to know that anyone, however expert, can make vastly better sections, at least for some and usually for most purposes, by the use of a proper holding instrument. Undoubtedly the sliding microtome is the best form, and an object holder that grasps the material is better than one in which the latter is wedged or im-

bedded; but these are also much more expensive in construction than the ordinary "well" microtome with a screw for raising the object. For this reason my own laboratory is supplied with the latter form of instrument, each student having one clamped to his table. For special work resort is had to the better instruments.

There are, however, two important improvements upon the old well-microtomes which cannot be dispensed with without serious loss in efficiency. The first is a glass top, the second is a removable tube fitting the well. My instruments are made to order, and cost two and a half dollars each. They are, however, of iron; brass is better. Each is furnished with two or three brass tubes, in which the objects are placed, instead of putting the latter directly in the well itself. The tubes fit the well exactly, and are closed at bottom with a cork. This latter may be pushed up with the object and its holding material to the proper height before placing the tube in the well. The screw works on the tube, raising the whole together. In this way not only is imbedding much easier, but the certainty of the proper movement consequent upon turning the screw is far greater. There is always the same amount of friction to overcome and there is no elastic spring to interfere. The microtome must be fitted for clamping to the edge of the table.

The object to be cut is wedged more or less firmly in the well-tube, according to the resistance offered to the knife. Delicate things may be put into pith, and by sloping the latter away so as to leave little of it to cut, the softest leaf or petal can be thus held sufficiently firm, without bruising. The latter is not nearly so likely to happen as when held in the fingers. Harder substances may be held by portions of velvet cork, this also being sloped properly away in a cone-shaped top.

In numerous instances, however, some method of imbedding is greatly preferable to simple wedging in the tube holder. For this purpose there are many substances having special merits, and there is no one superior to others for all purposes. The nearest to this, however, for botanical uses is a soap mass, the only one to be herein described.

Take good, white hard soap ("Ivory" soap is excellent), cut in very thin slices, and having gently compressed them in a suitable dish, pour in enough, 95 per cent., alcohol to somewhat more than cover the sliced soap. Heat to near the boiling point of the alcohol until the soap is dissolved. Add now a small quantity of glycerine. The amount of the latter can be readily ascertained by pouring out a few drops of the warm mixture and allowing it to cool. Without any glycerine the mass instantly congeals into a white friable substance quite unfit for our purpose, but as a proportion is gradually added the mass hardens less and less

rapidly and becomes more and more transparent. For soft tissues the imbedding mass may be thus made as transparent as glass, and exquisite for cutting. For harder substances less glycerine must be used.

With this imbedding material fresh vegetable tissues need no preceding preparation, provided there is not a large amount of water in them, while substances preserved in alcohol are admirably adapted for immediate use. If infiltration is desired it is only necessary to keep the object some time in the warm mass. It is clean, and the instruments remain clean. The transparency enables one to see clearly the position of the object and to manage well the cutting. Thin sections are not so liable to roll up as with most other masses. It is readily soluble in water, but not in cold alcohol. In cutting, it is better to keep the razor and the object wetted with the latter, and transfer the sections to the former. If a well tube to imbed in is not at hand, pour the melted mass into any convenient dish or paper tray, immerse the object, and when the mass cools, cut it out and shape as required.

In cutting, let the razor rest flat on the glass top of the microtome *and hold it firmly with both hands.* Make a long draw or push stroke, so that a considerable portion of the edge of the razor is used each cut. See to it that there is not the least vibration of the blade by which the edge may be nicked. If everything is in order, and the handling properly done, it is surprising how hard substances may be cut without this last occurrence. We ought not to be satisfied until we can readily cut sections one-thousandth of an inch thick without tearing or bruising.

Short Papers and Notes.

Argyroneta Aquatica.

THIS wonderful little Arachnid, so common in the fens and ditches about Oxford and Cambridgeshire, has been found within the last few years to inhabit similar pieces of water in some parts of Scotland. In a standing pool on Luffness Links, near Edinburgh, they have been found. The water is murky, a thick layer of mud at the bottom, the surface covered with water-plants, the roots of which are imbedded in the mud. Only last summer (1885) a "haul of

spiders" was made from the peat mosses of the Pentlands, near Balerno. Formed so as to require atmospheric air, though living in the water, "*Argyroneta*" spins for herself a thimble-shaped dome of delicate silken fibre, attached to the stem of some water-plant, which dome she renders habitable by filling it with air. This she accomplishes by making successive journeys to the surface, bringing down the air, entangled in the hairy-like fur which covers her body; thus, by degrees, she fills the thimble-shaped dome, the air ascending to the roof gradually displacing the water: and here in this silvery hall she lives, performing all the duties and enjoying all the pleasures of an active and happy life. Even when swimming freely through the water, ascending to the top to breathe, or to catch water-flies, or to bring down supplies of air, the skin of the spider is never wet, as the bells of air, which glisten over her body, act as a sure body-guard. Unlike others of the spider tribe, "*Argyroneta*" has the "happy knack" of taking no responsibility for the growth or education of her offspring after birth. Within her airy dome she spins a silken cocoon which contains her hundred eggs, out of which, as soon as the hundred little spiders are hatched, they begin at once to spin and live as she does.

As to the feeding of "*Argyroneta*" in an aquarium, they seem to find Infusoria swarming on the leaves of water-plants, especially on the *Anacharis* weed; but some experiments were tried lately by offering them larger game. A fair-sized "Blue fly" being placed in the water, was instantly seized by a spider and carried down a few inches from the top. She then spun a silken cord from the fly to the surface, up and down which she travelled, bringing a supply of air on every occasion, till a dome was formed round the "game," and there she made a delicious repast. They treated gnats and earwigs in the same way, but only took to earwigs if hard pressed, and certainly with a look of disdain! It is thought that the spiders hybernate during winter, either on land or in one of their domes. A net is used in capturing them, and generally the domes are destroyed, but when settled again in quiet water they begin to spin at once. It is a most interesting sight to see one of these habitations filled with air.

Minnie M. Kean.

A Method for the Preparation of Sections for Examination with the highest powers.

There is perhaps no more successful plan for demonstrating the minute structure of animals than Dr. Beale's process of

preparing and staining tissues in glycerine and then teasing them out with needles, followed by the judicious application of heat and pressure, and finally mounting in pure glycerine.

This process is of course based on the fact that delicate structures are liable to very rapid change when placed "in water or other fluid media of less density than that with which they were bathed during life." I quote from Dr. Beale.

This method, however, in great measure prevents the use of the freezing microtome, as glycerine will not freeze, or rather freezes at a temperature not easily attainable; and similarly solutions in which glycerine is present in greater or less quantity freeze with relative difficulty.

Of late years exceedingly perfect freezing microtomes have been made by which sections even 1–200th thick may be obtained without any great difficulty. Amongst others may be mentioned Williams' microtome, worked with either ice and salt or ether spray. This is the one I use and can recommend. Now, it is evident that such sections might with advantage be examined with the highest powers even up to 1–50th oil immersion were they prepared by the glycerine or any other method giving similar results. If prepared in the ordinary way with a watery solution, the use of any higher power than the 1–8th would probably only lead to disappointment and a disbelief in the utility of high powers.

I have, when preparing material for section-cutting in the ordinary way, in most cases obtained the best results with picric acid; and on reading Dr. Beale's work, "How to work with the Microscope," and trying his method on a frog, it occurred to me whether the substitution of a colloid, such as gum, or a saturated solution of picric acid in gum, for the glycerine at one stage of the process might not act as well as glycerine in preventing change, and at the same time allow sections fit for examination with the highest powers to be cut.

I have carried out this process and find it answer well. My plan is to place the fresh material, cut into small pieces, in Dr. Beale's glycerine carmine until the bioplasm is stained (10 to 15 hours), or better, inject the whole body or part with the stronger glycerine carmine, as recommended by Dr. Beale, and allow it to remain until stained; it should then be cut into pieces. After this place it in 2 parts glycerine to 1 water for 24 hours, followed by pure glycerine saturated with picric acid for 48 hours. The pieces are then taken out of the glycerine and (of course without washing) placed in a thick solution of gum acacia, also saturated with picric acid, for 48 hours. The small quantity of glycerine which adheres to them when placed in the gum and picric acid does not much retard freezing, and sections may easily be cut.

As soon as the sections are cut they are placed in a mixture of

5 drops of acetic acid to the ounce of glycerine, and after remaining in this several days or a week will have swelled out to their original size if shrunk at first by the glycerine, and may then be mounted in glycerine with a trace of acid in the usual way.

Of course, as mentioned by Dr. Beale, any other stain may be used with glycerine in the same way as carmine, although for this method it must be a stain which is unaffected by picric acid. It is possible that it may not be necessary to use glycerine at all except for the final mounting, if Farrant's medium (glycerine and gum) be used, but I have not as yet tried placing the fresh tissue at once into gum and picric acid.

I daresay this is nothing new; in fact, it is but a combination of two well-known processes. Perhaps, however, some few of the readers of this Journal who are the fortunate possessors of high powers may like to try it.

J. William Gifford.

Anæsthetics on Plants.

Having read some very interesting experiments, and also very instructive ones, by Claude Bernard, on the action of ether and chloroform on plants, I tried some myself, and will give my own experience. Having grown some strong, healthy, sensitive plants, I placed them under a bell-glass, and quite excluded all outward air. To some I administered a strong dose of ether, to others a strong dose of chloroform, by saturating cotton-wool with one of these, and placing it under the glass with the plant; then, according to the dose, and the time the plants were under the influence of the anæsthetics, so the time differed on their recovery when brought into the fresh air. In less than half-an-hour the plants showed they were in a state of anæsthesia, and their leaves stood quite erect, and showed no desire to shrink when touched, and if taken out then, they soon recovered, when placed in the air, and their irritability or sensitiveness soon returned, and they responded to the touch as usual. Some plants which I kept under their influence for some hours did not recover their irritability for 3 days, and one plant, that remained under the influence of chloroform for a longer period, though remaining quite healthy, never again responded to the touch or showed any sign of irritability, though I kept it for 3 months afterwards, and then by misadventure it was thrown away, which I was sorry for, as it would have been interesting to know if its sensitiveness had been arrested for ever, or if it would have recovered in the spring, when the sap rose again. These experiments were tried about midsummer. Claude Bernard gives interesting experiments on

seeds, particularly cress seed, but here, as I cannot relate my own experience, I quote his remarks. He says :—The seeds of cress germinate very quickly when placed under favourable conditions, and when thus placed, if exposed to the influence of ether, the germination, which would have shown itself the next day, was stopped ; for 5 or 6 days the seeds showed no disposition to germinate : they were not killed, they only slept ; and when exposed to the ordinary air again, soon germinated, and that with activity. All these experiments show that plants, like animals, may be placed, just in the same manner, under the influence of anæsthetics. When the vapour of chloroform is inhaled by a human being, it passes into the lungs and is absorbed by the blood (in which is the protoplasm), and thus carried by circulation into all parts of the body, first the brain and then the rest of the body becomes unconscious. So the leaves of the plants, with their multitude of stomata, inhale the ether, which, through the circulation of the protoplasm, is carried all through the plant. Anyone who has studied the circulation in a leaf of the *Valisneria spiralis* under the microscope, and has watched the streams of liquid protoplasm carrying along the grains of chlorophyll, will know how quickly this may be done. Other researches all prove that "the life thereof" is the same in both the animal and vegetable kingdoms. Chlorophyll (the colouring matter in plants) is found in some of the lower animals, such as the stentor, hydra, and others, differentiated in the protoplasm, and some students go even farther and say they have found granules of starch in their tissues. Mr. Darwin also shows similar phenomena in the two organic kingdoms, in his researches among the carnivorous plants, such as *Drosera*, *Pinguicula*, etc., which, after having caught their living prey, the animal matter is absorbed by the plant, being digested by a secretion (called by some vegetable pepsine), which acts like the gastric juice of animals.

M. A. HENTY.

Answers to Queries.

2.—Adelges Fagi.—Is Mr. Fitzgerald sure the insect that he noticed on the beech-trees is *Adelges Fagi?* I saw several beech-trees last summer, which were covered, more especially on the under side of the leaves and stems, with what appeared to be a sort

of white fungus; but, on examination, I found it was caused by a species of Aphis. The paths under the trees were quite stained from the sap or secretion caused by these insects.

H. F. J.

3.—Mounting Acari.—The parts of the mouth and legs, upon which the characters are usually founded, may be best made out by crushing the animal upon a slide with a thin cover glass, and washing away the exuding substance with water; sometimes a hot solution of potash is required, with a subsequent addition of acetic acid, and further washing. When afterwards dried and mounted in Canada balsam, the various parts become beautifully distinct.

M. D.

4.—Mounting Algæ.—In the laboratory of Professor de Bary, at Strasburg, a one per cent. solution of carbolic acid in water is used. I have some which I mounted there five years ago, and on looking at them to-day find them in excellent preservation. Make a cell with an asphalte or gold-size ring, cement first with two coats of Chinese cement (shellac dissolved in alcohol), and then ring with asphalte.

B. Sc., Plymouth.

4.—Mounting Algæ.—Obtain as pure a gathering of *Volvox*, or *Desmids*, as possible, stand the beaker containing them in a window for a couple of days, by which time the bulk of the little organisms will have collected close to the side of the vessel nearest the light; then pick up with a pipette as many *Volvoces* as are required, and place them in a watch-glass containing a small quantity of the following fluid, known as "Hantsch's fluid":—Rectified spirit, 3; Distilled water, 2; Glycerine, sp. gr. 1250, 1. Put the watch-glass under a bell-glass, and leave it there three or four weeks; at the end of this time the water and spirit will have evaporated, and the Algæ will remain in pure glycerine. By this slow process of osmosis, the colour and form of the Algæ are preserved better than by any other method known to me. Five years ago I mounted several slides of *Volvox*, *Desmids*, etc., by this process; the slides are as good now as when they were first put up. Further details may be found in J. Nave's little work, "The Collector's Handy Book."

P. E. Wallis.

4.—Mounting Algæ.—I think Mr. Lett will find acetate of potassium in strong solution (one part acetate to two of water) is worth a trial. I am using it for some of the more delicate confervæ with, apparently, fairly good results.

Zadig.

4.—Mounting Algæ.—The best medium for mounting delicate fresh-water algæ is glycerine and water. They are placed in water, and glycerine added drop by drop until incipient shrinkage is observed, and if now mounted in this, without more glycerine, they will soon regain their original size. This is the only method I know by which algæ retain their colour; it was recommended me by a well-known professional mounter, and I have never known it fail.

J. WILLIAM GIFFORD.

6.—Foreign Lepidoptera.—Into a biscuit or other tin box, put a layer of sand about 2 or 3 inches deep. Water the sand and gently pour off excess. Drop a little methylated spirit here and there on the sand to keep down the mould. Place a piece of white blotting paper over the sand and on it place the specimens by means of a forceps, in a single layer. Thick-bodied specimens will require 2 or 3 days' relaxing, while those with thinner bodies can be sometimes manipulated in a day. Cover the box with a well-damped cloth. I have relaxed hundreds in this manner, but they are more difficult to set than freshly-killed specimens, and if Mr. White has never tried his hand at setting, I would advise him to get a practical lesson from an entomological friend.

C. J. W.

6.—Foreign Lepidoptera.—To relax butterflies when stiff, the following method is recommended:—Fill a shallow dish or saucer with damp sand; cover with 2 or 3 folds of blotting paper, and place the insects thereon. Put the whole under a bell-glass. The time will of course depend on the stiffness of the insects, some relaxing more rapidly than others. Care should be taken that the blotting paper does not get sufficiently wet to soak the insects; otherwise they will be spoiled.

ZADIG.

7.—Yeast.—Young Chemist will see a detailed account of the structure of the yeast plant, with laboratory exercises, in Huxley and Martin's "Elementary Biology," a work that he should procure.

J. W. WILLIAMS, D.Sc.

7.—Yeast.—Take some fresh baker's yeast, and sow a small quantity in a little "*Pasteur's solution with sugar*" set aside in a warm place. In a short time the yeast will commence to ferment, when it is ready for examination. A little may then be placed on a glass slide, and examined in the ordinary way. A power of at least 800 diameters will be necessary for a satisfactory investigation.

If it is desired to watch the growth of the yeast, a moist chamber will be required. This is readily made as follows:—

Cut a piece of stout cardboard to the size of an ordinary 3-in. by 1-in. slide; punch a hole in the centre, about ⅓-in. in diameter; soak the cardboard in water so as to thoroughly saturate it, and fasten it down on a glass slide with two small india-rubber bands. A drop of fluid containing the growing yeast is placed on a piece of thin glass, and inverted over the hole in the cardboard. The object is thus held in suspension on the under surface of the cover; and any loss by evaporation is prevented by keeping the cardboard thoroughly moist.

The ingredients for making Pasteur's fluid, with and without sugar, may be obtained for a few pence from Messrs. F. E. Becker & Co., of 34, Maiden Lane, Covent Garden.

Full directions for the cultivation and examination of yeast will be found in Huxley & Martin's "Practical Biology."

ZADIG.

9.—Growth of Organisms under the Influence of Electricity. —You will find a detailed account of these experiments of Mr. Crosse in "Noad's Electricity"; also in *Trans. Royal Society* for 1852.

E. T. S.

9.—Growth of Organisms under the Influence of Electricity. —Some account of Mr. Crosse's Mites can be found at page 270 in "Economic Entomology," by A. Murray, F.L.S.

C. J. W.

9.—Growth of Organisms under the Influence of Electricity. —The question of the growth of Organisms under the influence of electricity, with special reference to Crosse's experiments, was finally disposed of by Prof. Sedgwick in his "Discourse on the Studies of the University of Cambridge," 1840, to which I would refer J. W. G., Preface, p. 24; also Supplement to Appendix, No. ii, p. 183. It is there shown that the alleged "low organisms" are as high in the scale of beings as *Acari*, a special habitat of some varieties of which is found in the glass and brass fittings of philosophical apparatus. It is only within the credibility of the credulous to swallow such a story as this, skipping from a supposed primordial cell to a highly-organised animal. I annex abridged extracts from the passages referred to:—

"It was affirmed . . . . that a *new animal* had been produced by a direct galvanic experiment, and without any pre-existing germs of animal life. . . . . It turned out, however, that this new marvel of nature's chemistry was but an old and well-known species of Acarus, of which the *Ova*, in tens of thousands probably, existed in the dusty corners of the very room where the first experiments were carried on. The creatures thus produced were not (as they ought to have been) low in the

organic scale, but were of a very complicated structure; and one of the pretended creations was a female well filled with eggs."—(Preface to the fifth edition, p. 24.)

"What are we called upon to believe when we are told of the galvanic creation of an Acarus? That galvanic forces can, without the help of any pre-existing vital germ, at once assemble together particles of dead matter, and arrange them in the complicated organic structure of an Acarus; and that the same forces can give this organic structure all the attributes of life and powers of reproduction. We know something of elective affinities, and we can modify these affinities by new modes of galvanic action. We can produce definite compounds, and definite crystalline forms, out of the definite combinations of dead and inorganic particles. But the formation, in this way, of a complicated organic structure is nothing less than a miracle, unless we suppose the pre-existence of some vital germ among the particles on which we experiment: for it refers to one system of causation, effects that are most widely apart in all their manifestations; and it is utterly abhorrent from all our experimental conceptions of chemical action and molecular arrangement."

"On no sane view of this theory can we produce an Acarus experimentally from dead matter without a long-ascending process of development—a process implying many specific transmutations, and many transcendental leaps from Order to Order."—"Supplement to Appendix," p. 183.)

W. B. K.

9.—Growth of Organisms under the Influence of Electricity.—J. W. G. will find a full account of Mr. Crosse's experiments in "The Memorials of Andrew Crosse, the Electrician," edited by his wife, and published by Longman & Co., 1857. The narrative is too long for insertion here, but I give a short extract from one of his letters to Miss Martineau on the subject:—

"As to the appearance of the *Acari* under long-continued electrical action, I have never in thought, word, or deed, given anyone a right to suppose that I considered them a creation, or even as a formation, from inorganic matter. To create is to form a something out of nothing. To annihilate is to reduce that something to a nothing. Both of these, of course, can only be the attributes of the Almighty. In fact, I can assure you most sacredly that I have never dreamed of any theory sufficient to account for their appearance."

W. Pumphrey.

11.—Black Varnish.—Like "V. A. L.," I would be glad to know of a varnish insoluble in alcohol, benzole, acetic acid, or potash; but am afraid it is an impossibility. Would he kindly

give his authority for the existence of this wonderful varnish? Asphalte is the basis of all the black varnishes, which have been in common use by microscopists for many years.

B. Sc., Plymouth.

12.—Remounting Slides.—Unless the cover is broken, it is seldom that slides require to be entirely remounted: usually the ring gets cracked, air gets in, and the mountant escapes; in this case put a drop of the mountant to the fissure, lay the slide slightly sloping in the sunshine, and the air will soon go; then re-ring the slide with Chinese cement and asphalte, or whichever varnish has been previously used.

B. Sc., Plymouth.

12.—Remounting Slides.—Plunge the slides into Spirits of Turpentine, and after a few days the cover-glasses will be found detached, and the specimens may be transferred to fresh slides and mounted at once. E. T. S.

Before putting the slide into Turpentine, tie a piece of thread over the cover-glass; this will prevent the object falling into the turps, and perhaps getting mixed with others. Ed.

13.—Cosmoline.— This is one of the very many fanciful names for the same thing (practically) brought into existence by Vaseline. They are all mixtures of the soft members of the paraffin series of hydro-carbons, and are obtained by treating the residues of the petroleum tanks, etc., by gentle simmerings and repeated filterings through animal charcoal; the many varieties are simply the results of prolonged contact with the charcoal. J. Hart.

15.—White Corpuscles of the Blood.—The cover-glass should be surrounded with oil to prevent evaporation. Care should also be taken that the stage is not too hot. The motion is stopped at a temperature of 50° C. Zadig.

16.—Double Staining Botanical Preparations.—The following method I have found very successful in showing clear differentiation, besides producing slides of great beauty (I am indebted to Professor Rothrock for the process): Immerse the cut in a *very, very weak* solution of aniline green for twenty-four hours. (At the end of twelve hours the cut will most likely have absorbed all the green, in which case add two drops more of the mother solution); then take a middling strong solution of Beale's carmine, and dip the cut in it for from *one* to *five* minutes only; then prepare with alcohol and clove-oil in the usual way, bedding in dammar, lac, or Canada balsam. B. Sc., Plymouth.

16.—Double Staining Botanical Preparations.—A. D. will find the following an easy and inexpensive mode, which is given in Mr. Hogg's work:—"The sections must be first immersed in an aqueous one per cent. solution of Crawshaw's aniline blue; then removed into a strong acetic acid solution, which fixes the dye in certain tissues, and removes it from others, while it prepares the unstained portion for the reception of another colouring material. It must be again removed into a weak solution of magenta (Judson's dye), acidulated with acetic acid: then washed and mounted in glycerine jelly. By this process sections of burdock are stained, the pith, very pale magenta; cellular tissue, deep magenta; spiral vessels of medullary sheath, deep blue; pitted vessels, blue; cambium, deep blue; liber vessels, dark magenta; lactiferous vessels, deep blue; cuticle, parenchyma, pale blue; epidermis, deep blue; hairs, pale magenta."

I have used this process and obtained good results, but as I have not experimented on burdock, the colours have not been quite the same. J. Benj. Bessell.

18.—Beetles on Sunflowers.—I noticed a small black beetle fertilising the Jerusalem artichoke. They were only to be found on a well-opened flower. I might mention that on each flower there were three or four humble-bees, which seemed quite intoxicated with the nectar, but the beetles did not seem to be affected.

H. F. J.

18.—Beetles on Sunflowers.—The beetle *Melegethes æneus* belongs to the Section Clavicornia, family Nitidulidæ. The various species of the genus *Melegethes* are difficult to determine, but the specimen sent is undoubtedly *æneus*, which is the commonest species and of most universal occurrence. In a South of Europe variety of this species a difference is observed in the shape of the angles of the thorax, the pubescence is also longer and greyer.

The life history of this species, with figures of the eggs, larvæ, &c., is given by Miss Ormerod in the *Entomologist's Monthly Magazine*, Vol. XI., pp. 46—52. R. G.

19.—Volvox globator.—This is a fairly widely distributed plant, and by no means uncommon. It may be found in clear pools in open elevated situations, particularly in reservoirs. I have frequently obtained great numbers by simply drawing a glass of water from a tap on the main. It abounds most in July and August. Zadig.

19.—Volvox globator.—As I have generally been very fortunate in obtaining good "dips" of these most beautiful objects, my experiences may be of some interest to your correspondent. I have found them to be most plentiful in rather shallow, but *clean* ponds, on commons and large *open* spaces. On Chislehurst, Mitcham, or Wandsworth Commons, I have rarely failed to secure a goodly supply during the summer months. During severe weather I have rarely come across any; I have also been unable to obtain any from running water. If Mr. Waddell will communicate with me, I shall be pleased to forward him a tube of Volvox the first opportunity. W. SHORT, Sidcup, Kent.

19.—Volvox globator.—I have not found the *Volvox globator* at all in the same way as described in the text-books. We have several ponds in our park, and though I find them every summer in one of them, and then in great quantities, they only last a few weeks, and I seldom find them in the same pond two years running. This I have always considered a curious fact: it shows they are very fitful visitors in some places. These ponds are very deep, and never dry up, or else one might suppose the wind wafted these tiny plants from one piece of water to another.

M. A. H.

20.—Spiders.—A. E. will find Staveley's "British Spiders," and O. P. Cambridge's "Spiders of Dorset" very cheap and reliable works on the subject. If he should require a more advanced treatise, he should consult Blackwall's "British Spiders," published by the Ray Society at about two guineas.

J. W. WILLIAMS, D. Sc.

The following questions remain unanswered:—

1.—Mounting the Antheridia and Archegonia of Ferns.

5.—Hairs of Mole.

8.—Mites found on Æcidium.

10.—Weevils.

14.—Stratena.

17.—Mounting Chemical Crystals.

21.—Pine Woods *v.* Raspberry Canes.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed before beginning their reply.

22.—Glastonbury Thorn.—Will some one tell me what a Glastonbury Thorn is? Are the flowers and leaves like an ordinary thorn? We have two thorns in our village (Nazing), which do not always behave like the common thorn; nor are they at all particular themselves as to their own time to leaf and flower. Last year on December 12th, 1885, they were both quite green; and one tree had several small bunches of flowers out on it; the other only showed a few flower-buds, as well as leaves. On a Good Friday, which fell in the year 1882 on the 7th of April, both trees were full of leaf and flower. Are these instances freaks of nature, or is it the way of these thorns? They are generally early, but sometimes they come out at the same time as the Common Thorn, or May, as it is usually called in the villages.

M. A. Henty.

23.—Landscape Photography.—Why are slow plates such as are made by Mr. Cadett and other well-known makers preferred by eminent photographers to ordinary rapid plates? I can understand that the finer deposit of silver with a slow plate gives a softer tone; but I have always understood that contrast is what is required for a good landscape photo. J. William Gifford.

24.—Safranine.—Have any of your readers had experience in the use of Safranine, as a staining fluid? If so, would they kindly tell the "Enquirer" how best to use it for parenchymatous structures, such as Liver, Lung, &c.? B.

26.—Food Adulteration.—Will anyone tell me, how through the Microscope I can find out what ingredient has been used to colour some anchovy paste, which when mixed with parsley, took all the colour out of it, leaving the parsley almost white? How can I find out if it is red lead, or any other colouring matter?

M. A. H.

27.—Chloride of Gold and Aniline Stains.—What is the action of Gold Chloride on those parts of the section which it does not

stain? Although it does not stain every portion of the section, it is quite evident, from the difference of the action of the Aniline dyes on those specimens prepared by gold from those hardened in any other manner, that it has some considerable influence upon them. F. A.

28.—Varnish for Background.—What is the best varnish to use for background illumination, which gives a fine, *smooth*, and dull colour? V. A. L.

29.—Moisture in Dry Mounted Diatoms.—I have had for three or four years a first-class test slide of *P. angulatum*, mounted dry on a thin cover-glass in a black varnish cell. About a year ago beads of moisture appeared on the slide; since then they have gradually increased in size. Will they continue to do so until the mount is entirely ruined, or can anything be done to save it? I shall also be glad to know what is the cause of moisture forming in this unpleasant way. V. A. L.

30.—Coal.—What is the best and simplest way to make preparations of coal for microscopic slides? A.

31.—Blood Corpuscles.—Dr. Carpenter says that "the red blood corpuscles present in every instance the form of a flattened disc, which is circular in man and most mammalia, but is oval in birds, reptiles, and fishes, as also a few mammalia (all belonging to the camel tribe)." Could any readers suggest what difference it makes to an animal whether its blood has circular or oval red corpuscles, and why the camel should differ from other mammalia in this respect? V. A. L.

32.—Brown spots on Old Books and Prints.—What is the cause of the brown spots so prevalent on old books and engravings? Is it a fungoid growth? The fact that they can be got rid of by bleaching with chlorine, or the fumes of ammonia, seem to indicate an organic origin. Q.

33.—Bromine.—The curious marine worm *Balanoglossus* gives off a strong odour of Bromine. It would be interesting to know or ascertain whether this element is present in larger quantities in this than in other seaworms. V. A. L.

34.—Botanical Synonyms.—Can any reader of the *Scientific Enquirer* tell me where to get a List of Synonyms used in Botany, both Phanerogamic and Cryptogamic?

EDWIN E. TURNER.

35.—Parasitism among Marine Animals.—In the extract from *Science* on this subject, mention is made of the fish which live beneath the umbrellas of Jelly-fish. Surely these fish would

cause great injury to the trailing hydrant; being constantly in contact the lasso-cells must be burst. Is this the case, or is there some provision of Nature to guard against the injury?

H. PUREFOY FITZGERALD.

36.—Trichophyton tonsurans.—Wanted to know the quickest and best way of demonstrating the conidia of this micro-fungus in cases of ring-worm of the scalp or body. The complete absence of these from the hair is the only satisfactory proof of cure; it is desirable therefore to have a ready, speedy, and conclusive method of microscopic examination. Will someone kindly furnish details? F. W. C.

37.—Vaccine Lymph.—Will one of your medical readers be good enough to furnish instructions for the microscopic examination of Human Vaccine Lymph? F. W. C.

38.—Dissecting Small Insects.—Can anyone who has had practical experience explain the process of making dissections of minute insects—say, for instance, a Beetle two lines in length? It is required to make a neat dissection of the mouth organs so as to preserve the various parts. What form of instrument is the best? and how is so small a thing to be held whilst working at it?

INSECTA.

Reviews.

ELEMENTS OF INORGANIC CHEMISTRY: Descriptive and Qualitative. By James H. Shepard, Instructor in Chemistry, Ypsilanti High School; cr. 8vo., pp. xix.—377. (London: G. P. Putnams and Sons, 27, King William Street, Strand. Boston, U.S.A.: D. C. Heath and Co.) 1885.

This in the hands of an efficient teacher will prove a very useful book for junior pupils, who have facilities for practical work in a good laboratory.

We notice the author coins the word "chemism" as a substitute for our more general, and we think preferable term, "Chemical affinity;" the word "valence" is also used for "valency." The book is nicely got up, and has about 20 illustrations.

THE LAKE DWELLINGS OF IRELAND; or, Ancient Lacustrine Habitations of Erin, commonly called Crannogs. By W. G. Wood-Martin, M.R.I.A., F.R.H.A.A.I., Lieut.-Colonel 8th Brigade North Irish Division R.A.; roy. 8vo, pp. xxii.—268. (Dublin: Hodges, Figgis, and Co. London: Longmans, Green, and Co.) 1886. Price 25s.

We have before us a very valuable and most interesting work, the object of the author being to place on record the remarkable discoveries made in a department of Archæology, hitherto almost unnoticed in Ireland, except in the proceedings and journals of various learned societies. Some idea of the thoroughness with which the author set about his task may be found from the following brief summary of the table of contents:—Lake Dwellings of all

Countries; of Ireland; Derivation of word "Crannog"; Ingenuity of Lake-dwellers; Clothing; Stone, Bronze, and Iron Ages; Food and Vegetable Remains; Household Economy; Articles of the Toilet or of Personal Adornment; Music; Amusements; Inscriptions; Money; House Furniture, etc., etc. This fine work is illustrated with 50 plates, besides a number of well-executed wood engravings.

READINGS FROM HUMOROUS AUTHORS: selected and arranged by John A. Jennings, M.A., post 8vo, 255 pp. (Dublin: Carson Bros.) Price 1s. This little book contains a number of amusing and interesting pieces.

PARABLES FROM NATURE. By Margaret Gatty, with a memoir by her daughter, by Juliana Horatia Ewing. First and second series, fcap. 4to, pp. 106 and 126. (London: Geo. Bell and Son. 1885-6.) Price 1s. each.

We have here 36 parables told in an interesting manner, several of which we have read with much interest; our attention was particularly attracted by one on red snow in which we have a popular description of this interesting Alga and an instructive lesson besides.

ONE THOUSAND PRACTICAL RECEIPTS in the Arts and Sciences, Trade, Manufactures, Chemistry, Domestic Economy, etc.; Fourteenth Thousand, 12mo, pp. 180. (London: Houlston and Sons.) 1882. Price 1s.

A Collection of 1049 Receipts and Directions in every conceivable branch of Trade, Science, Domestic Economy, etc., with a copious Index.

A YOUNG WIFE'S PERPLEXITIES, with Hints on the Training and Instruction of Young Servants. By Mrs. Warren; post 8vo, pp. 94. (London: Houlston and Sons.) 1886.

A book full of useful common sense. We are told the facts are from life, not imaginary: all the characters existed—are not fictitious. We have instructions for keeping house on £150 and on £100 a year, with many other matters of general interest to the young wife.

We have pleasure in stating that a continuation of the papers which appeared last year in *Science Gossip* entitled GRAPHIC MICROSCOPY, will be published in a separate form by Mr. E. T. Draper, F.R.M.S., to commence on 1st of March. Each number will contain two coloured plates drawn from Nature, with descriptive letter-press. The price of the monthly issue will be One Shilling.

We learn also that a fourth Volume of Mr. A. C. Cole's Studies will be commenced shortly; we shall take the earliest opportunity of giving our readers full particulars.

A GLOSSARY OF WORDS used by the Rural Population in the Parish and Neighbourhood of WINCANTON, Somerset. Compiled and sold by George Sweetman, Wincanton. Price 2d.

A little Glossary of upwards of 400 Words, in a great measure peculiar to the district, although a few of them may be considered as vulgarisms common to any village, we having heard them repeatedly in Cambridgeshire and Essex. Our author is a little out in his entomology, when he describes "Daddylonglegs, a long-legged spider," and "Deathwatch, a ticking spider, whose tick foretells death."

Answers to Correspondents, &c.

All Contributions SHOULD reach us by the 10th of the month, and cannot be inserted unless we receive them before the 14th.

M. A. H.—Thanks for your various contributions; we can only admit part this time. We shall gladly enlarge the *Enquirer* so soon as the number of our subscribers will allow us to do so.

A. de S. G.—We thank you for pointing out Geographical error in our exchange notice. We do not usually read these notices with as much care as more important matter.

J. W. G.—We shall be glad of the paper you so kindly offer.

V. A. L.—Your query, "Why do dry mounts such as diatoms and the like fail?" is, we think, too vague. If you will describe in what manner your dry mounts fail, we have no doubt many of our friends will be ready to help you.

F. N. P.—We do not know Balsam of Copaiva as a mounting medium, but as it is a natural oleo-resin it may probably answer for such a purpose. We never experience any difficulty with Canada balsam in benzole.

Contributions have been received from—H. F. J., J. Hart, H. S. M., Thos. P., J. Deans, V. A. L., A., M. A. H., R. A. R. Bennett, H. P. F., P. E. W., M. F., A. H. Waters, Insecta, R. G., A. W. G., etc. All the above stand over. We hope to find room for them in our next.

Sale and Exchange Column.

All Exchange Notices are inserted free; for Notices of Books, Scientific Instruments, or Accessories offered for sale, a charge of 4d. for the first 12 words and 1d. for every succeeding 3 words will be made.

Wanted, Standard Works on the Cryptogamia. Will give Cassell's Races of Mankind, 4 vols. in 2, half calf; Cassell's Wild Flowers, 5 vols., whole roan (both new), in exchange.—Edwin E. Turner, The Printing Office, Coggeshall, Essex.

Micro. Slides.—Two beautiful objects for Polariscope, viz.—Spiculæ of Synapta *in situ*, and Leg of Cockchafer, showing muscular structure; in exchange for two good insect mounts.—J. B. Bessell, Fremantle Sq., Bristol.

British Sponges.—Eight Species freshly gathered—named; including Halichondria rosea, 2s.; Parasites of Chough and Gannet, in spirits, three each, in separate tubes, 1s. 6d.; all post free.—C. Jefferys, Tenby.

Brook's bent double nose-piece for Microscope; cost 30s., nearly new. What exchange?—J. E. Fawcett, Rawdon, Leeds.

MICROSCOPICAL SLIDE LABELS for Animal and Vegetable Kingdom, toned paper, 6d. per 100; Samples of 33 kinds, 2d.—Chas. Watkins.

Insects in Spirit and Dry, selected for Mounting. New List ready.—Chas. Watkins, King's Mill House, Painswick, Gloucestershire.

Wanted, Members for Scientific Circulating Magazine Society.—T. F. Uttley, 17, Brazennose Street, Manchester.

The Scientific Enquirer.

APRIL, 1886.

Method of Mounting Objects with Carbolic Acid.

BY THOMAS STEEL, NAUSORI MILL, REWA RIVER, FIJI.

ALL objects suitable for putting up in balsam may be prepared by this method with great advantage, in so far as my experience goes. I first met with the process of carbolic-acid mounting in the *Journal of the Microscopical Society of Victoria*, Vol. I., p. 50, but my method of manipulation differs somewhat from that there detailed.

Suppose the object to be mounted to be an insect such as a flea, it is treated with potash or soda in the usual manner, to render it transparent; it is then rinsed in water and passed into spirit. The carbolic acid is prepared as follows:—Take, say, 1 oz. of Calvert's pure solid acid, and melt it by placing the bottle in a cup of warm water; when thoroughly fluid, add about 30 drops of spirit and shake well; now allow to cool, when it should remain liquid; if it crystallises again, melt as before, and add 10 or 15 drops more spirit, and again shake and allow to cool. If necessary, this operation is repeated until the acid remains permanently liquid. Now melt a portion of balsam on the slide, and remove air-bubbles in usual manner; heat the balsam until it is sufficiently evaporated to become firm on cooling; allow to cool. Place now three little pieces of broken cover-glass, or of thin wire cut short, as supports for the cover-glass, fixing them by placing a tiny tick of carbolic acid on the surface of the balsam where each support is to lie. In the meantime the object has been removed from the spirit and placed in a short test-tube containing some of the carbolic acid. I use a little flat-bottomed tube, about three inches long by five-eighths of an inch in diameter, fitted with a little light handle of split cane. The object is allowed to soak until quite saturated with the acid, or it may be gently boiled, which is the

quickest way. If boiled, the mouth of the tube should be held in such a manner that should the hot spirit flow out—which it is sometimes liable to do—it may not fly into the face or do other damage. It should also be borne in mind that the vapour of carbolic acid is inflammable. When boiling, the tube should be kept shaken in the same manner as a chemist shakes a test-tube; the little handle is of great use in holding the hot tube. A few seconds is all the heating required.

This boiling is a capital way of getting rid of air-bubbles which may exist about the object, and if necessary the tube should be allowed to cool and again heated, and this will seldom fail to displace any persistent bubbles. The object being now thoroughly permeated by the acid, the tube is allowed to cool. A drop of carbolic acid is now placed on the surface of the hard, cool balsam on the slide by means of a dipping-tube; the object is then taken out of the tube on a mounted needle, or the contents of the tube emptied into a little dish, and the object taken out and at once placed in the drop of acid on the slide and arranged as desired. The cover-glass is now taken in the forceps, and a drop of the acid spread on its under surface. Should any air-bubbles appear in this drop of acid during the spreading, they are best got rid of by holding the cover-glass for a moment over the lamp. The cover-glass is carefully placed in position and held in place by means of a light wire clip. The excess of acid is absorbed by little pieces of bibulous paper; odd cuttings of the Swedish filter-paper used by chemists are very good for this purpose.

When the excess has been absorbed, the slide is gently warmed, and as the balsam softens, the spring clip presses the cover-glass down into position: the acid, as it exudes, is absorbed by pieces of filter or blotting paper. The bulk of the surplus balsam is also removed by little scoops made of small pieces of paper. The slide, with the clip still on, is now baked in the usual manner. A little water-oven, such as is used by chemists, is exceedingly handy for this purpose, and will save many a vexatious loss of slides through over-baking.

Six to twelve hours is sufficient baking for most slides, but that depends on the degree to which the balsam has been evaporated before placing the object. When the operation of baking has been satisfactorily accomplished, the slides are allowed to cool, always keeping on the clip till they are quite cold. The superfluous hard balsam is best cleaned off by putting a little methylated spirit on each slide, and allowing to stand for a few minutes. The spirit dissolves out certain portions of the balsam, leaving a friable mass of white resinous matter; this is displaced by scraping it gently with an old pocket-knife, and washed from the slide with a

little more spirit. The chemist's wash-bottle is very convenient for this. The slide is then washed under the tap and brushed carefully with an old tooth-brush, when it only requires to be wiped dry with a soft cloth and finished off as suits the taste. This method of mounting I have used for a great variety of objects with highly successful results. The carbolic acid has the good property of drawing itself together and not spreading all over the slide as turpentine does.

I have also used this process by mounting objects in carbolic acid, and "running in" thinned balsam or dammar solution, and found it to answer perfectly. Delicate calcareous objects may be boiled in carbolic acid without damage. In the matter of ringing glycerine mounts, I may here remark that in the heat of the tropics I have found the gold-size and liquid marine glue supplied by Mr. T. D. Russell to be very good. I have a good number of slides secured with these, and they are almost all in perfect condition, though it is now nearly a year since I gave them a coat. Even the fine mounts in Coles' studies give way—that is, the glycerine ones—to the heat here, but a coat or two of the marine glue puts them all right.

Short Papers and Notes.

The "Water Ouzel," or Common Dipper.

HAVING often seen this active little bird flying over mountain-streams in Keebleshire, and having acquired some facts, from the practical observations of friends, about its habits, I would like to give them here, as it is an interesting little creature, owing to the diversity of opinion as to its powers of diving and walking at the bottom of streams, without using any apparent muscular effort. The Water-Ouzel, *Cinclus Aquaticus*, is one of the thrush tribe, its internal structure as to muscles and organs of voice being the same. It frequents rocky mountain-streams and rivers, feeding principally upon insects and water molluscs. In every instance in which we examined the contents of the stomach, no trace of salmon spawn was discovered, so we hope that gradually its character as a salmon-ova thief will be cleared. It is destroyed foolishly throughout Scotland on the plea of this false accusation. The

bird measures about seven inches and a half in length, and is of a brownish-black colour, with the exception of the breast, which is pure white. The song of the Ouzel is particularly sweet. It is called the "water thrush" in Spain and some parts of England. In Islay the Ouzel is seen in large numbers, and there some observations were made as to its so-called diving and walking powers. Its short wings are well formed for diving, and, watching it from a bridge, it was seen to cleave the water; then it flew, not walked, rapidly along the bottom, employing the extended wings just as if flying in air, great force being used to counteract the law of gravity. It reappeared again on the stream above the bridge, and was hidden from view in a mossy bank; and on going to the bank and searching, we discovered its nest, which is of a very peculiar shape. It is domed and very large, built of closely-interwoven moss; the chamber in the centre, to which an entrance is gained by a small hole on one side of the nest, is lined with dry leaves. There were six white eggs in it, each measuring about an inch in length.

MINNIE MCKEAN.

Another New Mounting Medium of High Refractive Index.

We learn from the *American Monthly Microscopical Journal* that Professor Hamilton L. Smith has recently discovered another medium, which he regards as superior to any hitherto described. It has a refractive index considerably above that of the Stannous oxide medium, and is prepared in the following manner:—

Dissolve one and one-third ounces of antimony bromide in two fluid drachms of a fifty per cent. solution of boro-glyceride. This, when cold, makes a very viscid medium, like old, stiff balsam, of a dark sherry-wine colour. Mounts made with it in the extremely thin film required are as colourless as with old balsam, and when laid upon white paper the colour of the medium is clearly perceptible if it has not been injured by over-heating—certainly less than most mounts in styrax.

It is used precisely like Canada balsam. It works easily at a moderate heat, and boils very readily. The heat must be continued until the boiling is nearly over, but care must be observed not to over-heat, as the glycerine is likely to burn. When entirely cooled, the cover will be firmly attached, as with balsam, and the slide may be cleaned with moist tissue paper without fear of disturbing the cover.

A finishing ring may now be applied, but Prof. Smith advises that a piece of paraffin should be placed on the slide, melted, and

caused to flow around the mount by tilting the preparation. A vigorous rubbing with a cloth will remove all excess of paraffin, leaving a sloping or bevelled ring round the mount. This operation has preserved mounts for two months already, with no indication of change. Any finishing cement may then be applied.

The medium is only slightly deliquescent, but is decomposed by water, and injured by contact with immersion fluids; hence some protection is necessary.

Process for giving a Dead Black Surface to Brass

Take two grains of lamp-black, put it into a smooth, shallow saucer, add a little gold-size, and thoroughly mix together. Just enough gold-size should be used to hold the lamp-black together. About three drops of such size as may be obtained by dipping the point of a lead pencil about half-an-inch into the gold-size will be found right for the above quantity of lamp-black; it should be added a drop at a time, however. After the lamp-black and gold-size are thoroughly mixed and worked, add twenty-four drops of turpentine, and again mix and work. It is then ready for use. Apply it thin with a camel's-hair brush, and when it is thoroughly dry the articles will have as fine a dead black as they did when they came from the optician's.—*The Locomotive.*

Compound Eyes of the Horse-Fly.

Mr. J. D. Hyatt, in his studies of compound eyes and multiple images, remarks as a curious peculiarity of the eyes of the horse-fly that the lenses of the upper and anterior part are much larger than those situated below a median line, the large facets having at least twice the diameter, or four times the superficial area, of the smaller. The larger lenses form pictures at a plane considerably above the focal plane of the smaller ones. Thus these insects are furnished with eyes of two varieties, corresponding to our long-sight and short-sight spectacles; in other words, with telescopic and microscopical eyes, the telescopic looking upward and forward and the microscopical downward.—*Popular Science Monthly.*

Moss found at Great Depth under Water.

Monsieur Bocion, of the Cantonal Industrial School of Lausanne, Switzerland, reports the discovery in Lake Leman of a bright-green moss growing in the bottom of the lake, on the calcareous rocks, two hundred feet below the surface. No other moss has been found at so great a depth under water; and how chlorophyll could have been so richly developed so far from the light is a problem.—*Popular Science Monthly.*

A Hint on the Keeping of Melicerta Ringens.

Some time ago, I found quite accidentally, in a corner of a dirty pond, near Dover, where I should never have thought of looking, a fine colony of *Melicerta ringens.*

I took home with me some pieces of the weed, on which there were nearly a dozen living, and placed them in a large-sized bell-glass aquarium. For about a week, they appeared to thrive and do well; at the end of a fortnight I found that, although they had considerably increased in numbers, they were certainly much smaller than at first, and as time went on they grew less, and at last disappeared altogether.

I now account for this disappearance, from the fact of my not having remembered, that I had taken them from a pond where the water was thick, and where they could find plenty of food and material for building their cases, and placed them in water, which, after a time, became so clear that they could obtain nothing from it for their brick-making. No doubt, if I had now and then thrown in a little fine earth, I should have kept this interesting rotifer alive for a long time.

I am also led to think that the search for the *Melicerta ringens* is often unsuccessful from the fact of seeking it in clear ponds instead of muddy. M. F.

Gum Tragacanth.

This is the best thing for mounting all small insects on cards, as it dries away and leaves no stain. It is also the best material for sticking labels on to glass. As it will not dissolve in water like gum arabic, some find difficulty in preparing it for use. The best way is to select three or four white pieces, about the size of a coffee-berry, and place in a 2-oz. wide-mouthed bottle; then pour over it acetic acid so as to hardly cover the gum, and place the bottle aside until the next day, by which time the gum will have absorbed the fluid, and become very much swollen. Now add water stir well, and in a day or two a semi-transparent jelly will be the result. A drop or two of pure carbolic acid should be added, and it will then keep for any length of time without getting mouldy.

R. G.

The Stannous Chloride Mounting Medium.

After a trial of the new medium discovered by Professor Hamilton Smith and referred to by the Editor on page 14 of No. 1 of this Journal, I venture to notice one or two facts in connection with it.

I find it necessary that the stannous chloride should be of the utmost purity, and therefore the quality known as tin crystals will prove the best.

As this salt is very unstable and deliquescent, and the mere addition of the glycerine jelly being almost sufficient to dissolve it, I do not see the need of so much heat.*

As a precaution against the admittance of air and the consequent re-crystallisation of this almost saturated solution, I draw a ring of gold-size on the turn-table, and when this is dry and hard, I put on a second layer, and finish off with thin Canada balsam in benzole.

The markings of various *Pleurosigmæ*, *Scoliopleura tumida*, and *Navicula firma*, stand out with a clearness and sharpness of outline which is quite remarkable.

ALFRED W. GRIFFIN.

The Army Worm.

A correspondent writing to *Chambers' Journal* says :—" When in Vicksburg lately, a cotton-planter there gave me some interesting particulars as to the means adopted for preventing the plague of the Army worm. This worm is the larva of an insect which is very destructive to the cotton-plant, and often strips whole acres nearly bare of foliage. At the time when the moth or butterfly, which is the product of it, is on the wing, an electric light is suspended over a large flat vat containing molasses or oil. The moth is attracted by the light, and after fluttering round, settles down, as it supposes, on the ground, but really in the oil or molasses, which drowns it. They tell me that one light is sufficient for 20,000 acres of land, and that in this way they can now control the Army worm."

Preservation of Soft Tissues.

According to Professor Semper, the tissues are first hardened by being steeped in chromic acid, which is afterwards thoroughly washed out in water. The specimen is then allowed to remain in absolute alcohol until the water is perfectly extracted, when it is placed in turpentine for 3 or 4 days. It may then be dried and mounted. Specimens prepared in this way retain their characteristics in a very satisfactory degree, and are strong and flexible ; the example strongly resembles kid. If the surface be treated after drying with a solution of sugar and

* As we read the instructions we understand that the crystals are to be dissolved in cold glycerine jelly ; the boiling we think is to cause a thorough mixing before filtering.—Ed.

glycerine, the natural colours will be restored ; but the specimens must then be kept in hermetically sealed glass cases to preserve them from dust. The only objection to this method is the expense of absolute alcohol for large specimens.

V. A. L.

Mounting the Anthers of Flowers.

Place the anthers in alcohol of 95 per cent. for about five minutes, gently rub them about, and then transfer them to distilled water. The cells then open in a remarkable manner, the pollen-grains are easily detached, and no trouble ensues from air-bubbles. Mount the specimens in glycerine.

V. A. L., from the Bull. Belgian Micros. Soc.

Answers to Queries.

1.—**Mounting Antheridia and Archegonia of Ferns.**—Let a frond of a fern whose fructification is mature be laid upon a piece of fine paper, with its spore-bearing surface downwards ; in the course of a day or two this paper will be found covered with a very fine brownish dust, which consists of discharged spores. Collect this carefully and place in a saucer, the bottom of which must be covered with water, and a glass tumbler should then be inverted over it ; the requisite supply of moisture is thus ensured, and the spores will germinate luxuriantly. Some of the prothallia soon advance beyond the rest, and at the time when the advanced ones have long ceased to produce antheridia, and bear abundance of archegonia, those least developed will be seen to be covered with antheridia. If the crop be now kept with little moisture for several weeks, and then suddenly watered, a large number of antheridia and archegonia will simultaneously open, and in a few hours afterwards the surface of the larger prothallia will be found almost covered with moving antherozoids. Such prothallia as exhibit freshly opened archegonia are now to be held between the index finger and thumb of the left hand, so that the upper surface of the prothallium lies upon the thumb ; the thinnest possible sections are then to be made with a thin narrow-bladed knife perpendicularly to the surface of the object. Of these sections (which require some little practice to make) some will probably lay open the canals of the archegonia, and within these antherozoids may

sometimes be found when magnified by powers varying from 200 to 300. The prothallium of the common *Osmunda regalis* will be found to offer peculiar facilities for observation of the development of the antheridia which are produced at its margin. They may be mounted in any of the following fluids :—

(1) Carbolic acid 1 drachm, alcohol 2 drachms, distilled water 12 ounces. Dissolve the acid with alcohol and add the water; then boil for ten minutes and bottle for use.

(2) Acetate of aluminium 1 part, distilled water 4 parts. This is also very good for preserving the colour in Desmids and other Algæ.

(3) Ralf's Liquid.

Archegonia are best mounted in Deane's Compound or any of the above-mentioned fluids. The practical work is given in Huxley and Martin's Biology. V. A. L.

4.—**Mounting Algæ.**—After trying all sorts of media with glycerine, carbolic acid, camphor, chloride of calcium, etc., I now use plain water, with the least addition of camphor water, to prevent fungoid growths from being afterwards developed. N.B.—I think the same pond water from which the Algæ is taken is the best. Most media have a specific gravity greater than that of water, and their effect is always to drive the endochrome into the middle of, or at any rate away from, the walls of the cells; whereas when plain water is used its natural disposition remains long unchanged. But I have never succeeded with *any* medium in preserving the green colour in any fresh-water Algæ with any degree of certainty; though lately I find that if kept in the dark they mostly remain as green as grass, whilst a few others are slightly brown. It does not seem to depend on the season at which plants are collected. I think, perhaps, the following precautions may aid in preserving colour :—(1) To use water recently boiled, and then closed up in a flask, so as to minimise the amount of air contained in it; (2) immediately after mounting to put the slide in the dark. I have had specimens spoiled in consequence of the plants growing after mounting and eliminating oxygen from the carbolic acid in solution in the water. As I believe the brown colour to be due to oxidation of the endochrome, these precautions might be of some use. Among my specimens are *Euglena*, *Closterium Liebleinii*, *Spirogyra*, *Volvox*, etc. V. A. L.

4.—**Mounting Algæ.**—I believe the following preserves the cell contents and natural colour and form of Desmids, Volvox, and other Algæ :—Dissolve 15 grains of acetate of copper in a mixture of 4 fluid ounces of camphor water, 4 fluid ounces of

distilled water, and 20 minims of glacial acetic acid; add 8 fluid ounces of Price's glycerine, and filter. When sections of plant stems or other vegetable specimens are mounted in this fluid the protoplasm is preserved. If in any case it is thought desirable to increase or diminish the specific gravity of the preservative, the proportion of glycerine may be changed. It is a trustworthy medium also for mounting Infusoria and the softer animal tissues. For Infusoria perchloride of iron should be used. After treatment with this the objects are washed in alcohol and stained with gallic acid, which produces a brownish colouration and renders the muscles very distinct. The specimens thus treated are mounted in balsam or glycerine; they are, however, better for observation when mounted in glycerine. V. A. L.

6.—Lepidoptera, to relax.—Having very recently received a large consignment of Lepidopterous insects from India, all of which I have reset, has given me a little practical experience. Each insect in this case was placed in a paper wrapper, with its wings closed, and in this way a large number were packed in cigar-boxes, etc., and forwarded by post. The plan I adopted for setting them, and which I found answered admirably, was as follows:—I found an old *tin* baking tray with upright sides, about 2½ inches deep and 18 inches square; this I half filled with wet sand, which, after being made smooth upon its surface, I covered with sheets of coarse bibulous paper. These I also moistened well, sopping up superfluous moisture with a sponge. I then placed the tray with its contents upon a level piece of board, covered with old felt carpet. Now respecting a cover for this tray. This I made with wood, just deep enough to cover the tin dish, *i.e.*, 3½ in. deep, and to go easy over it. This wood tray I covered inside with felt, and when I use it the felt is well wetted, and any superfluous moisture removed with a sponge.

The insects are now placed upon the blotting paper which covers the sand, and the tray covered and allowed to remain thus for about 24 hours—*i.e.*, for butterflies; stouter bodied moths will require double that length of time, but it is easy to test them as the relaxing goes on, and remove them only when they are sufficiently relaxed, allowing the others to remain longer.

G. N. M.

Beetles and hard insects may be relaxed by steeping them in hot water, or by being placed in a tightly-corked bottle containing chopped laurel leaves. There will be found to be sufficient dampness in the leaves for the purpose, and the prussic acid given off by them prevents the formation of mould. INSECTA.

9.—The Growth of Organisms under the Influence of Electricity.—The following extract from *The Intellectual Observer*, Vol. I., pp. 378-9, will, perhaps, be the answer required by your correspondent "J. W. G.":—

"The simple facts are recorded by Dr. Noad in the first volume of his *Manual of Electricity*, from which we extract a few of the most important particulars. In the course of his numerous experiments on electro-crystallisation the philosopher of Broomfield operated upon a solution of silicate of potash, which he supersaturated by hydrochloric acid, and allowed to fall in drops upon a piece of porous red oxide of iron from Vesuvius, connected by platinum wires with a voltaic battery. On the fourteenth day he noticed a few whitish excrescencies, or nipples, which proceeded to develop filaments, and on the twenty-second day assumed the forms of perfect acari. Mr. Crosse observed when these facts were commented on: 'I never ventured an opinion as to the cause of their birth, and for a very good reason—I was unable to form one.' He succeeded in obtaining similar acari in solutions of nitrate and sulphate of copper, sulphate of potash, and fluosilicic acid. The latter experiment occupied eight months, when the creatures appeared at the negative pole. Mr. Weeks, of Sandwich, repeated these experiments with silicate of potash 'inverted over mercury,' the greatest possible care being taken to shut out extraneous matter, and in some cases filling the receivers with oxygen gas. In these instances the acari appeared after the lapse of more than a year. Dr. Noad made similar trials, and after more than sixteen months found the acari on and about the terminal cells of the battery, but not within the bell-jars. Mr. Crosse repeated his experiments, with greater precaution to exclude extraneous matter, and with the same results; but he discovered that it was necessary, as mentioned by Mr. Slack in the discussion at the Microscopical Society, to furnish the little animals with the means of emerging from the fluid. He noticed that 'if he let an acarus fall into the fluid under which he was born he was immediately drowned,' and Mr. Weeks observed the same fact. In another case the acari were developed in an atmosphere of chlorine, but they were motionless, and Mr. Crosse remarked: 'Whether the chlorine prevented their complete animation I cannot say.'"

To the above extract I think it better to add another from the second volume of the same journal, page 390, entitled—

"**The Acari of Solutions.**—From a paper read by Mr. Shadbolt, and from observations made thereupon at a recent meeting of the Microscopical Society of London, it appears that the acari which occurred in the electrical experiments of Mr. Crosse and Mr. Weeks, and which have since been found in

nitrate of silver baths, belong to a species widely diffused. Numbers have been discovered adhering to the walls of a room, and they make their way into any fluids that may be accessible. Thus the mystery of their origin is cleared up, as it might have been long ago if philosophers had not fancied that their orthodoxy would be compromised by investigating any fact that for the moment appeared to support the theory of spontaneous generation. It is still puzzling to know how they manage to exist in solutions of a caustic or poisonous kind, which, to all appearances, can contain nothing for them to eat. Mr. Richard Beck exhibited a fine specimen under a binocular microscope, and it closely resembled the *Acarus Crossii* figured in "Noad's Electricity." R. G.

11.—Black Varnish.—I am sorry to say that I do not know who is the authority on the varnish. I have seen a similar question asked some years since in one of the numerous papers, but which I forget. I certainly should like to know of it, if in existence! V. A. L.

15.—White Corpuscles of the Blood.—The following description of how to observe the Amœba-like movement of white blood-corpuscles is from Schäfer's Practical Histology, and will afford to A. E. the information he requires :—

"In order properly to study the vital phenomena which are displayed by the white blood-corpuscles, it is necessary in the case of man and warm-blooded animals to maintain the drop of blood under observation at or near the temperature of the body. For this purpose we employ what is known as a warm stage, of which there are several forms in use. The simplest consists merely of an oblong copper plate, two inches by one inch, from one side of which a rod of the same metal, four or five inches long, projects. This plate has a round aperture in the middle, half an inch in diameter, and is fastened to an ordinary slide by sealing-wax. The preparation is made as follows :—Take first a clean, large-sized (one inch square) cover-glass, which in this case is to be used instead of a slide, and on it place a small drop of salt-solution (one part of sodium chloride to 150 or 200 of water). With this mix thoroughly with a needle about an equal amount of blood obtained from the finger, and carefully cover the mixed liquid with another cover-glass, somewhat smaller than the first. If there is now not enough fluid to cover the space between the two glasses, add a little more salt-solution at one edge of the smaller cover-glass; but if, on the other hand, there is too much, soak up the excess with a small piece of blotting-paper. A very small camel-hair pencil, which has been dipped in olive oil, is now to be

drawn gently along each edge of the smaller glass; this will prevent evaporation from the edges, which would otherwise quickly ensue on warming the preparation. The dilution of the blood with salt-solution prevents in great measure the aggregation of the red corpuscles, while at the same time in no way interfering with the movements of the white ones; moreover, it is favourable to the changes which the above-mentioned masses or colonies of discoid particles undergo, if any such happen to be present. The glass slide which bears the copper plate having been clamped on to the microscope stage, the preparation thus made is placed upon the copper, and, having been brought in focus, one or more white corpuscles are selected for observation—a high magnifying power being used. The rod is now heated near its end by a small spirit-lamp, and the heat is conducted by the rod to the copper plate, and from this is transmitted to the preparation, close to which a small fragment of a mixture of white wax and cacao-butter, previously made, and melting at about 30° C., is to be placed upon the copper. The lamp is now gradually approached along the rod until it arrives at a spot, the heat transmitted from which is just sufficient partially to melt the fragment, and it is then left burning at that spot; for, since the fat employed melts at about the temperature of the body, we know that the preparation will now be also warmed nearly to the same point.

It will be seen that as the preparation begins to get warm the white corpuscles, which were, perhaps, previously rounded and inert, begin to throw out processes and exhibit amœboid movements, which become more and more marked as the temperature rises, so that by virtue of these an actual change of place from one part of the field to another may be effected. It is well in making this observation to select a single corpuscle and to sketch its outline and that of its more immediate surroundings, at intervals of half a minute. As the corpuscles become spread out in creeping along the glass, one or more nuclei may sometimes be seen indistinctly in them; more often, perhaps, clear spaces or vacuoles are to be seen in their protoplasm."

T. Sympson, Lincoln.

15.—White Corpuscles of the Blood.—There should be little difficulty in seeing the amœboid movements. The best way to notice these changes is to make drawings from time to time—say every two minutes—of a colourless corpuscle. I have seen a corpuscle actually divide into two. These changes take place well in the blood of the newt at the ordinary temperature of the air, but more rapidly when the slide is warmed on a hot stage. Be careful to surround the cover with a little oil, or, better, with a ring of melted paraffin, to prevent evaporation. Human blood is most difficult, on account of the small size of the corpuscles.

V. A. L.

16.—Double Staining Botanical Preparations.—A very good account will be found in Hardwicke's *Science Gossip* for 1880. Double staining of vegetable sections is divided into three distinct stages, viz. :—(1) Bleaching the sections; (2) staining in carmine; (3) staining in aniline green and mounting. Any time may elapse between the three stages. The annexed is an abstract I made, having only a few hours in the evening and as many minutes in the morning to spare for microscopy :—

First evening, cut and put to bleach. Morning before second evening, wash.

Second evening, wash and transfer to water and spirits. Morning before third evening, place in mordant.

Third evening, place in carmine dye for one hour, wash in water and nitric acid; preserve in alcohol. Morning before fourth evening, place in aniline for twelve hours.

Fourth evening, wash, place in oil of cloves, and mount.

H. F. J.

16.—Double Staining Botanical Preparations.—One of the most simple differential stains for wood sections, etc., is picro-carmine, as the staining is effected at one operation. The woody fibre is stained yellow and the rest of the section red. Another good stain is carmine and aniline green. Although I have made many experiments in this direction I have not yet arrived at any really satisfactory result. The two methods above mentioned give by far the best results of any combination of stains I have tried.

J. Deans, Frant Hurst, Bournemouth.

19—Volvox globator.—This little plant will generally be found in small ponds, ditches, and streams, where the water is clear and still and exposed to the light and warmth of the sun; on bright days near the surface of the water.

It is of little use looking in ponds overshadowed by bushes and trees, or where the water is disturbed by cattle or waterfowl, or overgrown with duckweed.

I have never found it in the winter; July and August are the best months.

M. F.

19.—Volvox globator.—As far as my experience goes this beautiful little plant is very widely distributed, but very capricious in its appearance. Quite recently, after the late severe frost, I found it swarming in a little roadside pond, which had been frozen hard for about a fortnight. I never saw it in a running stream, but I fancy in most ponds with clear water Volvox is to be found at some time of the year.

P. E. Wallis.

[Some years ago we collected Volvox in great abundance in

the river Ouse at St. Ives, in Huntingdonshire. We used to get it in a bottle, fixed to the end of our walking-stick.—Ed.]

22.—Glastonbury Thorn.—*The* Glastonbury Thorn is a large thorn tree which grows by a wall near the entrance to the ruins of Glastonbury Abbey. The tree is supposed to have been planted by Joseph of Arimathæa when he came over to England to convert the English to the Christian faith (according to tradition). The trunk is about 3½ inches in diameter. I do not know of any variety of that name, but I have heard of a variety of thorn called the Milk Thorn, which used to have strange ways about flowering, but I am not sure what it did. Glastonbury Thorns are all seedlings from the one supposed to have been planted by Joseph of Arimathæa on Wearyall Hill. It is the fourth variety of the *Cratoegus*, or hawthorn, and blossoms twice a year. Its winter blossoms appear about Christmas and are about as big as a sixpence. H. S. Montgomerie.

24.—Safranine.—I have used this stain for some time, and will refer B. to the article on "The Microscope, and how to use it," in the *Journal of Microscopy and Natural Science*, Vol. IV., p. 242, I do not recommend the stain for normal tissue for *very* permanent work. If required for staining amyloid substances use as follows :—Sections to be immersed in a watery solution of safranine (one or two grains to the ounce) ; it rapidly stains the amyloid substance a beautiful orange colour, while the rest of the section will be *rose* colour. Epithelial cells are more deeply tinted than connective tissue. Thick tissues and those hardened in alcohol stain well, but not those which have been hardened in chromic acid or the bichromates. Acetic acid destroys the value of the test, the entire specimen being stained of a uniform rose-tint in the presence of this acid. Should a normal bronchus be stained, I would recommend a double stain, either of eosin and logwood, carmine and logwood, or picro carmine and iodine green. *(See Journal of Microscopy, January, 1886, page 38.)* They will all show special features. If any further particulars are required, I shall be glad to assist B, if he will communicate with me.

V. A. L., 15, Thorncliffe Grove, Manchester.

36.—Trichopyton tonsurans.—A very ready and efficient mode of demonstrating the conidia of *Trichophyton* is to soak the affected hair in ether, wash thoroughly in distilled water, then in liquor potassæ, and next place it in a little glycerine upon a clean side. A thin covering-glass is then to be *gently* dropped upon it. The ether will dissolve out fatty matters, and the liquor potassæ will render the hair translucent. T. Sympson, Lincoln.

Trichophyton tonsurans, or *Tinea tonsurans, Achorion Schœnleinii.*—The latter, which is found in the root-sheath or bulb of hair, and has groups of rounded conidia. It is best prepared by staining in methyl-aniline violet, washing carefully in distilled water, and mounting in glycerine. It may also be soaked in water and treated with caustic potash or acetic acid, or it may be treated with a mixture of alcohol 2 parts, ammonia 1 part, and mounted in distilled water. I usually pull out a few diseased hairs and put them on slip, apply cover glass, and allow a few drops of weak caustic potash to flow under to clear up any adventitious matter, and it renders the several parts of the fungus more distinct. Examine with $\frac{1}{4}$-inch objective. Another way is to mount specimens of the fungus and separate them, and add a drop or two of spirit. When this has evaporated add a drop of glycerine solution or balsam dissolved in chloroform, and put on a glass cover. If the balsam renders the asci too transparent, use gelatine ; no cells are required. I also take a hair or two and put it in a drop of glycerine, cover, and examine with one-fifth objective. V. A. L.

37.—Vaccine Lymph.—For examining rare fluids containing crystals or lymph, place a little in an ordinary fine vaccine tube, as supplied for taking lymph off a child's arm, seal the ends in a gas flame, taking care not to heat the fluid. Next take a slip of cardboard (thin) about the size of a glass slide, cut out a space in the centre in the shape of a diamond, place the tube, which is about one-sixteenth of an inch in diameter, over the centre of the card, and gum a strip of gummed paper across the tube, leaving the ends to project past the strip. I find this a very useful method for some chemical solutions. C.

The following questions remain unanswered :—

No. I.

5.—Hairs of Mole.
10.—Weevils.
14.—Stratena.
17.—Mounting Chemical Crystals.
21.—Pine Woods *v.* Raspberry Canes.

No. II.

23.—Landscape Photography.
26.—Food Adulteration.
27.—Chloride of Gold and Aniline Stains.
28.—Varnish for Background.
29.—Moisture in Dry-Mounted Diatoms.

30.—Coal.
31.—Blood Corpuscles.
32.—Brown Spots on Old Books and Prints.
33.—Bromine.
34.—Botanical Synonyms.
35.—Parasitism among Marine Animals.
38.—Dissecting Small Insects.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply.

39.—Scientific Names.—I should be greatly obliged if any one will give me the name of a book which explains the meaning of the Latin and Greek words by which Diatoms and other microscopic objects are named. Although I know a little of these languages, I sometimes have great difficulty in finding the meaning of them. I have seen dictionaries which explain the terms used in Botany and Geology, but have not been able to meet with one in which Microscopy is included. I am sure there must be many others to whom such a book would be most useful. J. B. B.

40.—Mounting Fish Skins.—What is the best way to mount fish skin (dried), as of grey mullet, dog-fish, etc.? A.

41.—Sections of the Earth-Worm.—Will some reader tell me the best and most satisfactory way to prepare longitudinal and transverse sections of the Earth-Worm? A.

42.—Aphides to Mount.—Can any reader inform me what method is most recommended for the examination of Aphides? I have seen specimens which show the embryos *in situ* most clearly, but I have been unable, up to the present time, to obtain satisfactory results. A.

43.—Dendritic Crystals.—I shall be glad of any information about these crystals, as I have been unable to find anything about

them in any of the microscopical books. Are they only found in common tinted paper? and are they of one metal only?

W. Short.

44.—Dead Black Varnish.—I am anxious to obtain the Black Varnish used many years ago for backing the glass plates of photographs. It dried dead black almost instantly with a hard surface, which could not readily be scratched away. Can any reader state where it can be obtained? R. H. M.

45.—Staining Sections of Tulip and other Bulbs.—I shall be glad if it is possible to stain sections of these, so as to show their internal structure. I wish to make permanent mounts of sections, showing the growth of the Tulip from bulb to seed-pod, and to take photo-micrographs of them. Any information on this subject will be welcomed. D. A.

46.—Air Bubbles in Botanical Mounts. — In mounting Botanical sections in Glycerine Jelly, how are air bubbles to be avoided, and how are they to be got rid of if they make their appearance after the cover-glass has been applied? F. E. C.

47.—Camera for Drawing Landscapes.—Some time ago I saw a portable Camera, which, by arrangement of the mirror, would throw the picture of the landscape or building on to a sheet of paper, so that it might be readily traced. I should much like to know how to construct such a one. Perhaps some of the readers of the *Scientific Enquirer* can tell me. Landscape.

48.—Barbadoes Earth.—I have several lumps of this earth, received direct from Barbadoes, and shall be glad if some one will tell me how to clean and prepare it, so as to preserve undamaged the beautiful organisms it contains. If some correspondent will describe carefully and fully how this is to be performed, it will doubtless be gladly read by many besides Amateur.

49.—Algæ.—I should like very much to obtain specimens of *Anabæna* and *Pandorina.* Are they to be found elsewhere than in Ireland? J. Hart.

50.—Colours for Photo-Transparencies.—Can anyone tell me what medium is used with oil colours for painting photographic transparencies for the magic lantern? I can find directions for painting on glass, but not on the photographic film. I have tried, and not succeeded well. A. C.

51.—Zinc Plates for Electric Battery.—I wish to know how the Zinc Plates, used in the porous cells of Galvanic Batteries, are amalgamated. I cannot make the mercury adhere to the zinc, do they require to be saturated with sulphuric acid before the mercury is applied? D. C.

Reviews.

A CLASSIFIED and Descriptive Catalogue of Scientific and Technical Books. 8vo, pp. iv.—216. (London: Geo. Phillip and Son. 1886.) Price 2s. 6d.

It often happens that we wish to read up certain subjects, but are at a loss to know what books are to be had that will give us the desired information. The Catalogue before us is what has been wanted for a long time. It is arranged according to subjects, which follow in alphabetical order, *e.g.*, Accoustics, Aërostation, Agriculture, etc., etc. Under each subject the books are alphabetically arranged, giving the author's name, title of book, size, publisher, and price. We notice date of publication is omitted, and that Scientific Journals are not mentioned. The book will, however, prove most useful, and we prophesy for it a large sale.

THE QUICKEST GUIDE to Breakfast, Dinner, and Supper. By Aunt Gertrude. (London: T. Fisher Unwin.) Price 1s.

A list of dishes, suitable for the different meals, with a short intimation of how they may be cooked; so arranged that those ordering may see at a glance what to order. Thus we notice 19 ways in which eggs may be served for breakfast.

AN INTERMEDIATE PHYSICAL AND DESCRIPTIVE GEOGRAPHY, abridged from the Physical, Historical, and Descriptive Geography. By the late Keith Johnston, F.R.G.S. Revised and corrected to date; post 8vo, pp. xi.—283. (London: Ed. Stanford. 1886.) Price 3s.

This is one of "The London Geographical Series" of School Books, and instructs the pupil in the Form and Dimensions of the Earth, its movements, the distribution of Land and Water, the Causes which determine Climate, etc., etc. It has two coloured plates, one explaining the seasons, the other showing the known world at four different epochs, besides several wood engravings.

THE REASON WHY (General Science): A Careful Collection of many Hundreds of Reasons for things which, though generally believed, are imperfectly understood. Crown 8vo, pp. xii.—340. (London: Houlston and Sons. 1883.) Price 2s. 6d.

An exceedingly useful little book, affording answers to such questions as everybody is supposed to know, but which few persons can satisfactorily explain. It is divided into eighty lessons, and throughout the book the subjects are treated in an alphabetical arrangement; nearly 1,400 questions are answered, and there are upwards of 80 engravings.

Answers to Correspondents, &c.

All Contributions SHOULD reach us by the 10th of the month, and cannot be inserted unless we receive them before the 14th.

John P. (Bombay).—Many thanks for reply to Query No. 6, which, although too late for insertion, we were nevertheless exceedingly pleased to receive. We shall hope to hear from you as often as convenient.

V. A. L. and others.—Please read carefully the notice which stands at the head of the "Queries" page. Each query or answer, no matter how short it may be, must be written on separate pieces of paper, and signed in the usual way. The full name and address, if it is wished that it should not appear, must be written at the bottom left-hand corner of the same sheet.

H. M. (Photo).—We shall be glad of your promised papers when convenient. We can produce any engravings required, but do not purpose introducing photos at present.

R. M.—We can afford *necessary* length for all replies ; at the same time, we think them more effective and valuable when written in a concise manner.

E. W. W. (Batley).—We are hoping to have papers from you very frequently.

We beg to thank R. A. R. Bennett, V. A. L., H. P. F., H. F. J., A. H. Waters, T. Pearson, Insecta, J. Hart, for replies to queries, which we think have been fully answered by other contributors ; we wish, however, to direct their attention to a long list of queries to which no answers have been received.

Sale and Exchange Column.

All Exchange Notices are inserted free ; for Notices of Books, Scientific Instruments, or Accessories offered for sale, a charge of 4d. for the first 12 words and 1d. for every succeeding 3 words will be made.

Wanted, Sections of Typical Ovaries of Plants, double Stained and Mounted. State price, or what required in exchange.—Address C. M. A., 29, Belvedere, Bath.

The Scientific Enquirer.

MAY, 1886.

Apparatus for Drying Botanical Specimens.

By T. E. Handford.

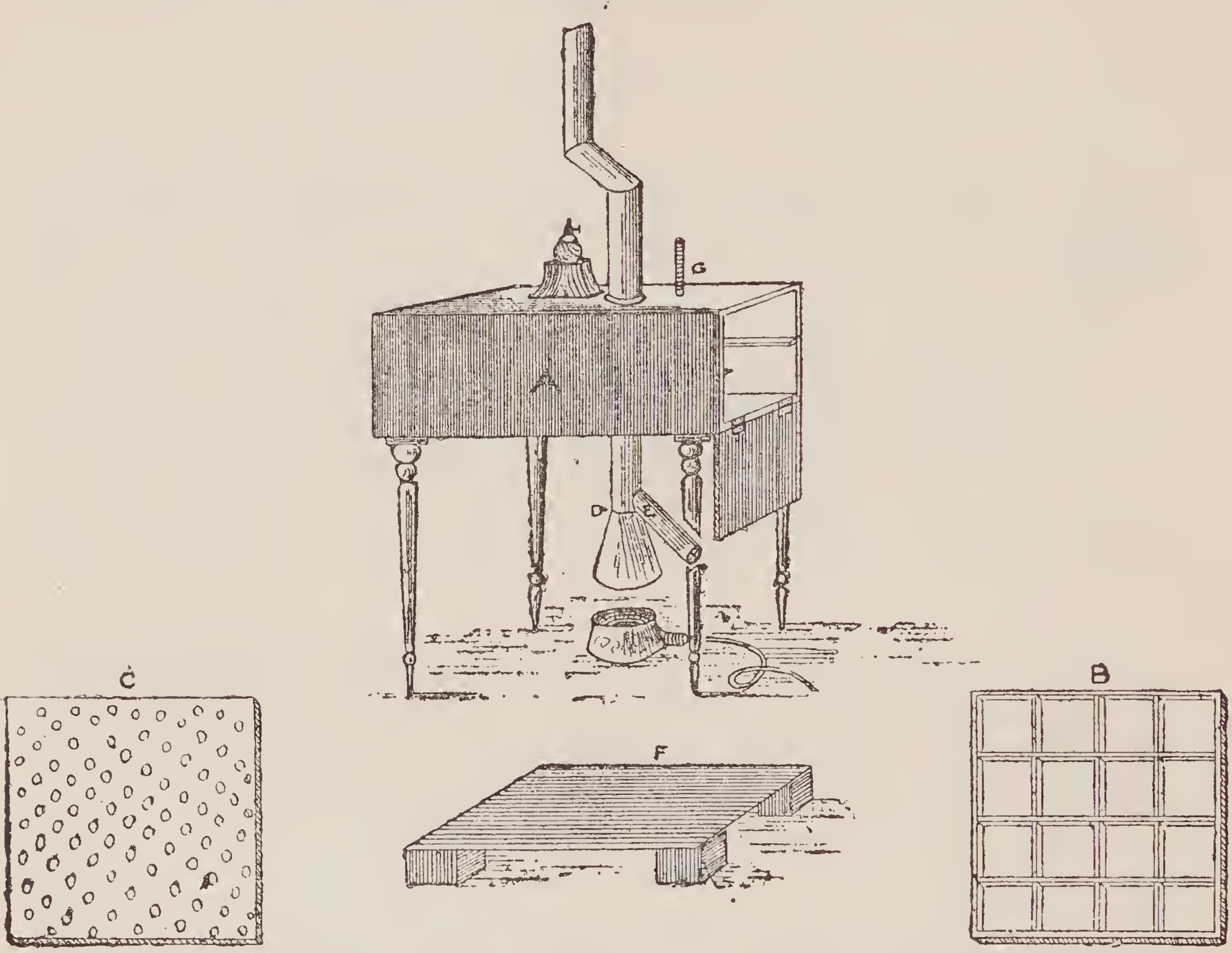
THOSE who have had occasion to press and dry plants with a view to subsequent preservation as specimens, will probably acknowledge that the method of drying them naturally, by simply pressing between bibulous paper, which, as it soon becomes damp, has frequently to be changed, is anything but satisfactory, both on account of the time and attention required, and the subsequent disappointment experienced, when, as is too often the case, the resulting specimen is almost unrecognisable, or when at least the fresh green colour of the foliage and the more delicate tints of the flowers are quite destroyed.

The aid of heat has often been suggested and employed, many having dried their plants between boards which have been placed in ovens, or in some warm spot over kitchen ranges, etc. ; here the difficulty has been to regulate the heat, which is sometimes much greater, and at others much less than required.

This led me to attempt to devise some special heating apparatus, and after many experiments with sand baths, from which some fairly good results were obtained, and other apparatus, I at last constructed a drying chamber, which I will describe, and which has given most satisfactory results, enabling me to dry and preserve specimens, of which I am, I think, justly proud. In constructing this apparatus, the main object was to ensure a continuous and rapid current of warm air being passed over the plants, while they were at the same time under moderate pressure. The apparatus consists of a stout wooden chamber (A), twenty inches long by twenty inches wide, and nine inches high, supported on legs, and provided with a hinged door in front, which opens downwards. To the inside are screwed two narrow strips of wood, which

support an iron frame (B) exactly fitting the chamber, and about $\frac{3}{4}$ of an inch thick. On this is laid a sheet of No. 12 perforated zinc of the same dimensions, which provides a perfectly flat surface on which to lay the plants, a couple of sheets of bibulous paper being placed under and a couple above them. Over all is laid a flat iron sheet (C) pierced with a number of holes, and weighing about 12 pounds.

In the bottom of the chamber a hole 3 inches in diameter is made, and into this is fitted a zinc cylinder, to which is soldered a zinc cone, with a flat copper bottom (D). Into the cylinder, just above the cone, is soldered a zinc tube (E) nine inches long, and two inches in diameter, on the end of which is fitted a brass "hit-and-miss" regulator, such as is usually seen on oven doors.



In the top of the chamber a similar sized hole is made to receive a zinc chimney, which is made with an elbow, and by heating the angle of which with a spirit lamp a quick draught can easily be created.

On the floor of the chamber, over the 3-inch aperture, a board (F), twelve inches long by ten inches wide, supported by four small blocks of wood, is placed, in order to diffuse and disperse the heat.

The heat is obtained from an ordinary gas-air stove, having a

ring of small jets, and is placed about three inches below the copper-bottomed cone, and by means of a thermometer (G) fixed inside the chamber just above the shelf, the temperature, which should never be allowed to exceed 90° Fahr., may be regulated.

The iron frame being made to slide in and out easily, the plants can be arranged on it, the covering sheet placed over them, and the whole slipped into the chamber with very little trouble.

No fixed rule can be laid down as to the number of plants that can be dried at once, or the time required, this depending entirely on the size and nature of the specimens, many being quite dried in six hours or even less, while a few require more than thirty-six hours.

To ensure satisfactory results, frequent observation is necessary, the process admitting of numerous modifications, according to the varying requirements of individual specimens.

Short Papers and Notes.

A Trap-door Spider at Work.*

BY MARY T. PALMER.

A TRAP DOOR spider, *Cteniza Californica*, which came from California in September, was put in a box with earth, and soon made a nest with a perfect door. She was found one morning occupying a hole three-quarters of an inch in diameter and deep enough to completely hide her, around which the ground had been cleared and smoothed, so that it was somewhat lower than the general level. Unfortunately, as this part of the work was done during the night, she accomplished it unobserved. She probably cleared the ground, however, as she had done on a former occasion, when she was seen to walk slowly sideways, with all the feet on one side held together, turning slightly at the same time, and sweeping all rubbish and coarser bits of earth before her. In digging the hole, she threw the earth to a distance, as was shown by numerous little irregular lumps of earth scattered over some moss at the farther side of the box. Later the spider was seen to dispose of more in the same manner, but it was done so quickly that the exact motion could not be distinguished.

During the day she busied herself in the burrow, apparently treading against the sides, in order to make a compact wall. At

* From *Science*.

night she rested, and nothing more was done until the following evening, when she commenced to build a straight ridge or rim of earth at one side of the hole. She brought up as much earth as could be carried under the mandibles, and placed it on the top of this rim. When it had been secured by several strokes of the fangs, the spider turned, and rubbed the spinnerets over the spot, and afterwards all along the edge. The spinnerets were applied directly to the surface, and were used not only to produce the silk, but also to smooth and model the edge.

This process was repeated until the rim was about a quarter of an inch in height, when the spider left it, and commenced a similar one on the opposite edge of the hole. Here she worked, as before, until she had made a ridge about half as high as the other, when she returned to the first, and during the next hour added to them both alternately. At the end of that time, she brought up the first load of earth which was not used in building, and deposited it as far away as she could reach, without leaving the burrow. As she withdrew, she turned, and attached a line of web to the edge of the second rim, by which it was pulled over the opening after she had disappeared from sight. Henceforth it was necessary to lift and turn back this rim (or flap, as it might now be called, to distinguish it from the true door) whenever she came up, unless, as sometimes happened, she had neglected to pull it down.

In the meantime, the first rim, which was to become the true door, had been gradually enlarged; but another hour elapsed before any attempt was made to pull it down. The spider then fastened a line to the upper edge, by which, after a long and steady pull from below, the structure was dragged over the opening, which it only half covered. It was immediately raised, and carefully re-adjusted in an upright position. After another half-hour, devoted to adding more earth to the two rims alternately, the first was again drawn down; but, being still too small, it was once more returned to the old position, and the work of enlargement continued. As nothing but persistence in this course seemed necessary to complete the door, the spider was allowed to work the rest of the night without supervision.

In the morning the spider had vanished. The entrance of the nest was closed, and the depression around it filled, so that its position was perfectly concealed. Naturally, it was supposed that the door was finished; but the next night proved this conclusion to be erroneous. When the spider was visited at three a.m., the door covered only three-quarters of the opening, and she was still employed in adding earth to the edge. During the day the entrance had evidently been closed by the true door and the flap, used together as a double or folding door, one side being much larger than the other. The flap, no longer needed as a cover, was

now turned back and pushed away, the opening thereby being considerably enlarged. More earth was subsequently placed over and around it, until it was completely hidden, and rendered useless. Before morning the true door had attained the necessary size, and the lining had been added to it; but the lining of the burrow was not entirely completed until some days later.

A piece cut from this door showed it to be a layer of earth with a single lining; while an old nest which came with the spider, and which she presumably made, was provided with a door having nine linings, each of the eight lower ones enclosing a rim of earth, by which the door had been enlarged.

The Cicada.

An account of a singular habit in the Cicada is related and illustrated by J. S. Newberry in the *School of Mines Quarterly*. In Rahway, N.J., a house had been built and a cellar dug in an orchard some time before the appearance of a brood of cicadas. The unused cellar was opened about the time of their advent, and the bottom was found to be thickly set with mud-cones or tubes from six to eight inches high and an inch or more in diameter, each of which had been formed by the pupa of a cicada that had emerged from the earth beneath the cellar. Finding a dark chamber, and apparently desiring to work up to daylight, the cicadas had taken the moist clay and of this formed pellets, with which the tubes were built up, apparently with the purpose of bridging over the vacancy, and thus reaching the surface. The tops of all were closed; but, on breaking some of them, the pupæ were seen, both in the hole in the ground and in the cone. After the cellar was opened, and light admitted, they stopped building, and made holes in the tops of the cones for exit. The author further remarks that in these facts there is evidence of the exercise of intelligence in the cicada, and a judicious adaptation of means to an end in circumstances that, it would seem, must have been without precedent in the experience of that or any preceding generation, and therefore for which no education of ancestors could have given a preparation. It is possible that the pupa of the cicada is sometimes embarrassed in its ascent to the surface by water, by too wet or too dry sand or mud; but it is hardly possible to imagine circumstances where the construction of a tunnel would be necessary. There seems to be no adequate explanation of the phenomena that will bring them within the scope of the theory according to which all our organs and faculties are the result of formative influences progressively developed through a long line of ancestors.—*Science.*

Balsam Mounts.

Text-books are indispensable to the beginner, but there is a wide circle of practical knowledge, which is acquired by every worker in every branch of labour for which he acknowledges his indebtedness to no text-books, but to his own experiments, trials, and errors. Thus it is in the case of mounting. The books give directions how to obtain such and such results, but they often fail us at a critical stage of the work. The books, of course, are not always to be blamed. They often embrace as much of elementary knowledge as it is possible to get between their two covers, but they cannot be encyclopædic in character, and embrace all possible contingencies, and anticipate the experiences of every worker. And herein lies the chief value of current literature—that it affords an opportunity for all who feel interested in and pursue any special subject to record their experiences for the benefit of others, by whose notes they are in turn benefited.

I have been led to these remarks by the remembrance of some of my earlier difficulties in microscopic mounting. The books always say use pressure with balsam mounts, and not only so, but such pressure as is exerted by a spring clip, or a lead weight, and so forth. Now, I never use pressure at all, excepting such as is necessary for placing the cover-glass flat upon the object, which pressure is removed immediately on the removal of the needle by which it is effected. Continued and heavy pressure I have found prolific of bubbles, for although they are squeezed out beautifully so long as the clip or weight is permitted to remain, the removal of the latter, by permitting of a very slight springing up of the cover-glass, causes them to enter the mount and disfigure it. A little consideration should convince one that pressure is a mistake. For if, where the balsam is made to enclose the object, the cover is pressed down with but a very moderate degree of force, and so left, as the balsam shrinks by the evaporation of its essential oil, it must pull the cover closer and closer to the slip, so that the ultimate pressure on the cover is in direct proportion to the amount of hardening which the balsam has undergone. This natural pulling downwards of the covering-glass is seen in fluid mounts enclosed in deep cells, for if the fluid diminishes in bulk the cover of a large cell will become hollow or depressed in the centre.

Again, I seldom mount in the viscid balsam, but almost always use it in the dilute form, with benzole or chloroform. Hence scarcely any appreciable pressure is required, I am seldom troubled with bubbles, the medium is ready for use in a moment, and the quantity to be used for any object can be adjusted to a nicety with a glass rod, so that the trouble of after cleaning off the slides is almost *nil.* Using it thus, I prefer balsam to any other

medium which I have tried, notwithstanding that the preparations of gelatine and glycerine are excellent for those objects which balsam renders too transparent. J. H.

A Library of Wooden Books.

One of the most curiously original collection of books in any Library is said to be a botanical collection in Warsenstein, in Germany. At first sight, the volumes appear like rough blocks of wood; but on closer examination, it is found that each is a complete history of the particular tree which it represents. At the back of the wood the bark has been removed from a space large enough to admit the scientific and common name of the tree as a title. One side is formed from the split-wood of the tree, showing its grain and natural fracture; the other shows the wood when worked smooth and varnished. One end shows the grain as left by the saw, and the other the finely polished wood. On opening the book one finds the fruit, seeds, leaves, and other produce of the tree, the moss which usually grows upon its trunk, and the insects which feed upon the various parts of the tree; to all this is added a well-printed description of the habits, usual location, and manner of growth of the tree.—*The Decorator and Furnisher.*

Spiders.

In a sheltered border of my garden, during the last summer, were vast numbers of the small brown hunting spider to be seen basking in the sun, and running in all directions when disturbed by a passing footstep.

I was looking at the same flower bed, on Sunday, the 21st March, when the sun was shining brightly, and the air was mild, although only a few hours after the breaking up of the frost which had lasted without intermission from early in January, and to my surprise the ground was swarming with the same description of Spider, as lively and active as if the weeks past had been a continued summer, instead of a protracted and severe winter.

The question is suggested, and I shall be glad if any correspondent will kindly answer it—what became of these Spiders during the cold weather? Did they find shelter in the crevices in the wall, and if so, what protection had they from the frost? Or did they burrow in the earth, or weave a lengthened tube, as the trap-door spiders? If so, they must have gone a considerable depth, for the frost penetrated some twelve inches beneath the surface. Any information on these points will be esteemed a favour.

J. W. Fisher.

Nightingales.

Nightingales have been heard on the second of this month, in a wood eleven or twelve miles on the north-side of London.—*April 7th, 1886.* W. B. K.

Microscopical Drawing.

By W. B. Kesteven, M.D.

I should like to draw the attention of your readers to a simple but most effective instrument for drawing objects under the Microscope, contrived by my son some few years ago, and of which the practical use has confirmed the value. It consists of an ordinary thin glass cover, fixed in a brass frame, which being arranged so as to revolve on its axis, can be placed at any angle required, in front of the eye-piece of the microscope—45° being that usually found to be of service. The body of the Microscope being placed horizontally, and the light carefully adjusted, the point of the pencil can easily be seen and followed as it traces the outlines of the picture thrown down on to the paper. The degree of illumination and inclination of light is to be attained by practice only. The size of the resultant drawing will of course depend upon the distance of the eye-piece of the microscope from the paper on which the drawing is to be made.

This instrument was made by Mr. G. P. Sutton, optician, 108, Holloway Road, and is of a trifling cost.

To Stain Fungi.

This may be accomplished by using a half-ounce solution of Gold Chloride, which stains the Fungus in from one to six hours, after which the specimen may be mounted in diluted glycerine.

V. A. Latham.

Odontophores of Snails.

These are best mounted in a weak form of Goadby's Solution, with just sufficient pressure to open out the ribbon, but not enough to reduce everything to a dead level (I do not recommend glycerine and water, or salt and water, although the former is preferable to the latter). These show splendidly under the polariscope. A.

To Mount Gizzards.

Kill a cricket, etc., with benzoline; cut off the extreme end and pull off the head, which will bring out the intestine, and digest it

for half-an-hour in a solution of Caustic Potash. Wash it well by shaking it in water to detach the muscular coat and the tracheæ; then slit it up and mount in Balsam by the carbolic acid process, as described in the April number of the *Enquirer*. V. A. L.

Reproduction of Microscopic Drawings.

Drawings made upon paper with Aniline (Graph) ink, manufactured by Messrs. Judson & Sons, 77, Southwark Street, London, E.C., may be extensively reproduced by placing them in contact with a layer of Glycerine Jelly, which produces a negative from which at least fifty copies may be easily obtained. By laying a sheet of writing paper upon the negative, a slight pressure or smoothing action of the finger will give a very clear impression. The jelly may be made by soaking two ounces of best glue in four ounces of water for two days, melting by means of heat, and when fluid, stirring in six ounces of commercial, but strong Glycerine.

V. A. LATHAM.

Storks.

A correspondent writing from Nyborg, Denmark, April 5th, says, "I see from my window the Storks have just arrived and are flying over."

An Electric Tree.

A remarkable Electric Tree has recently been discovered in New Guinea, by two German explorers. According to *Colonies and India*, when these explorers reached a certain spot twelve days' distant from the coast, they found their compass useless, owing to the presence of a tree which so completely possessed the properties of a highly charged electric battery, that one of the travellers was knocked down with the shock when he touched it. Analysis showed the tree to consist of almost pure carbon, and it has been named *Elsassia electrica*.

What is an Atom?

Professor Peter F. Austen says, *Chemist and Druggist*, that an Atom is quite a small affair, but of big importance. The atoms of the temperature of freezing water are estimated to move seventy miles a minute, and suffer 17,000,000 collisions in a second. That is, the direction of the motion of the hydrogen molecule must change 17,000,000 times in a second. How difficult it would be to find out where one of these little fellows was after it

had the start of you a few minutes. In air, the collisions between the particles of oxygen and nitrogen, in a second of time, are about 8,900,000, and their average velocity is about eighteen miles a minute. In one cubic foot of air, it is estimated that there are 300 quintillions of particles, (three with twenty cyphers after it), and each of these flying particles changes its direction about 8,900,000 times a second. But even then the cubic inch of air is by no means full, for the particles have a free space to move in between the collisions, of from 6 to 10,000,000 of an inch. Sir William Thompson has just published a calculation by which he shows that the average size of an atom is not less than six, and not greater than sixty billionths of a cubic inch. Hence, in spite of the number of them in a cubic inch of air, the space is but partly filled.—*Mon. Mag. Pharmacy.*

Answers to Queries.

9.—The Acari of Solutions.—The late Mr. Crosse would, I opine, have indignantly repudiated the epithet *Crossii*, as applied to the Acari which were seen within his laboratory. A more correct designation, I think, would be *Acarus Vestigiorum*, as it was in "Vestiges of Natural History of Creation" that they were first brought under popular notice.

W. B. K.

11.—Black Varnish.—Mr. Topping used Black Japan for making his cells. When dried by gentle heat it becomes very hard and tough, and will withstand the action of proof Spirit. Potash, Benzole, and Acetic Acid, will in a short time destroy any Varnish, however hard.

M. F.

17.—Mounting Chemical Crystals.—The following directions were given in a P.M.S. note-book several years ago:—"Pure Canada Balsam is undoubtedly the best medium at present known for mounting, but can only be used for crystals of which it is not a solvent, as Asparagine, Salicene, Phloridine. Most of the Potassium and Sodium salts mount well in Balsam when allowed to dry without heat. Gum dammar in benzole is the next best medium, and may be used in some cases when balsam would dissolve the crystals, as Ammonium chloride, Zinc sulphate, Sodium-biborate, Quinine sulphate. Still, there are many salts for which neither can be used, and a good medium may be found in Copal dissolved in fusil oil. Some crystals can only be mounted

dry." I have mounted some in balsam and benzole. As to the method of preparation, the usual way is to make a strong solution of the crystals in water or alcohol, and having warmed a slide, to drop on the centre a little of the solution and evaporate by gentle heat, that is, holding four or five inches above the flame of a spirit-lamp. With some substances, a better result will be obtained by placing some of the solution on a cold slide, and allowing it to evaporate slowly, while with others, after heating the slide till the crystals begin to appear as little points all over, the slide may be placed on a cold surface. A. C.

19.—Volvox globator.—My acquaintance with this Alga is somewhat different from that of M. F., p. 54. I found it in 1884, in a pond close to the Lagan River, about two miles from Belfast, where it was so abundant as to tinge the water of a green colour, and the pond was overgrown with *Lemna* or Duckweed. And what was not a little remarkable, the four species *gibba*, *minor*, *trisulca*, and *polyrhiza*, were all growing together, so that the same handful contained specimens of all.

H. W. Lett, M.A.

26.—Food Adulteration.—In Hassall's "Food and its Adulterations" it is stated that the most usual adulterations in Anchovy Paste are "Bole Armenian," and "Venetian Red" which may be detected by spreading minute portions of the paste on a slip of glass, and examining it as an opaque object, when very minute particles of the earth can be detected. If some of the paste is put into a glass of water, the adulterations, being heavier than the paste, will sink to the bottom, and can thus be examined. For my own part I should prefer the chemical method as being more certain. If a little of the paste is put into some nitric acid in a test tube, and boiled for some time, the adulterations will dissolve. If this solution, which must be filtered to free it from the paste, gives a black precipitate on adding solution of Hydrogen Sulphide, red lead was present in the paste. If it does not give this black precipitate, but gives a black one on adding solution of ammonium sulphide, this indicates the presence of Bole Armenian (Ferric Oxide). But there is no reason to suppose that either is present, simply from the fact of the paste bleaching the parsley, since neither of them would produce that effect.

R. A. R. Bennett.

26.—Food Adulteration.—You will have great difficulty in determining red lead with the microscope, as it is so mixed up with organic colour, unless you can take advantage of its great specific gravity. Try to separate it by shaking up some of the paste

vigorously with much water, and remove the first red particles which fall. A better way would be to burn some of the paste in a porcelain crucible, with good access of air, and test the ash, after dissolving in Hydrochloric acid, for lead, with the usual tests: Sulphuretted Hydrogen, Sulphuric Acid, Potassic Bichromate, etc.

Your observation of the bleaching power of this paste for chlorophyll is of some interest, especially if you can prove it to contain red lead, as under certain conditions it is possible for this substance to cause chlorine to be evolved from common salt.

J. W. G.

30.—Coal.—It is a very difficult matter to make satisfactory sections of coal, and to meet this difficulty various plans have been devised, according to the kind of coal it is desired to make the section of. If the coal is sufficiently tenacious, it may be cut very thin with a knife, and cemented to a slip of glass with marine glue, instead of Canada Balsam, when it can be ground down to the required thinness by means of a grindstone or emery wheel. If it will not stand this treatment the following method may be used, which comes from the "Micrographic Dictionary:"—"The coal is macerated for about a week in solution of carbonate of potash; at the end of this time it is possible to cut a thin slice with a razor. These slices are then placed in a watch-glass with strong Nitric Acid, covered, and gently heated; they soon turn brownish, then yellow; when the process must be stopped by dropping the whole into a saucer of cold water, or else the coal would be dissolved. The slices thus treated appear of a darkish amber colour, very transparent, and exhibit the structure, when existing, most clearly; we have obtained longitudinal and transverse sections of coniferous wood from various coals in this way. The specimens are best preserved in glycerine, in cells. We find that spirit renders them opaque, and even Canada Balsam has the same defect."

R. A. R. Bennett, Magdalen College, Oxford.

32.—Brown Spots on Old Books and Prints.—It is a fungus, probably the one known as *Chætomium elatum*, which resembles small brown tufts of hair, common on paper, etc.; or if the paper is in a very damp place it may be *Chætomium chartarum* in which case the "brittle-mould" is surrounded by a yellowish spot: this is not so common as the former. This information I have culled from the books on Fungi by M. C. Cooke.

R. A. R. Bennett.

34.—Botanical Synonyms.—A goodly number of Synonyms may be found in the Encyclopædia of Plants, edited by J. C. Loudon, F.L.S. (London: Longman, Rees, and Co. 1829. Now out of print.)

The querist will find there the Scientific, English, French, German, Dutch, Italian, Spanish, etc., etc., all arranged in tabular form. J. W. G.

38.—Dissecting Small Insects.—If the insects are small, why not mount the heads entire,—treating them in this manner?—

Place in Potash till transparent, then wash well in distilled water, then place in Acetic Acid for two days, again wash in distilled water. The head should now be perfectly clean, and a little pressure will show all the parts of the mouth in their proper positions.

I think "Insecta" will find this method more satisfactory than dissecting the mouths of small insects. M. F.

39.—Scientific Names.—The "Micrographical Dictionary," by Griffith and Henfrey, with the aid of a Greek or Latin Lexicon, will, I think, help J. B. B. to the etymology of the words by which Diatoms and other microscopic objects are named. W. B. K.

39.—Scientific Names.—Loudon's Encyclopædia of Plants gives the meaning of many of the names of the Cryptogamia.

J. W. G.

40.—Mounting Fish Skins.—The Fish Skins should first be thoroughly cleaned with potash and water, and then completely dried. I give my specimens a couple of months in a warm spot, to be certain of no moisture remaining. I then cut a disc, to fill a tin or other cell, and mount dry, fastening the cover-glass as well as the cell with gold size. Mounted in this way, the skins of Fish with the scales *in situ* make beautiful and instructive objects.

H. W. Lett, M.A.

40.—Mounting Fish Skins.—If it is desired to mount these for the Polariscope, they should be carefully washed, then dried under pressure, soaked in spirit of Turpentine for two or three days, and mounted in Balsam or Balsam and Benzole in the usual way.

It is well, however, to have them mounted both as transparent and opaque objects. In the latter case, it is only necessary to wash the skin perfectly clean, and then dry thoroughly under pressure as before. J. Benjamin Bessell, Bristol.

42.—Aphides to Mount.—"A" can examine Aphides, see the embryos *in situ*, and even watch the birth process as I have done, without any mounting. Use one of those glass slides made with the cells in them, or ring a cell with Bell's cement or black varnish, put in half-a-dozen freshly-gathered aphides, put on the cover-glass, and examine with a $\frac{1}{4}$-inch objective, and he will probably see all he wants. B. Sc., Plymouth.

44.—Dead Black Varnish.—I do not know where this varnish can be obtained. Perhaps, R. H. M. would like to make it himself. India-rubber, ½ drachm; Asphaltum, 4 ounces; *Mineral* naphtha, 10 ounces. Dissolve the India-rubber in the Naphtha, then add the Asphaltum.

There are three very important things in making this varnish, viz.: the india-rubber must be pure, also the asphaltum, and the naphtha must be mineral, not wood. Some years ago this varnish was used by photographers; it is very adhesive, and will not crack.

M. F.

44.—Dead Black Varnish.—Try Solomon's, 22, Red Lion Square, High Holborn, London, W.C.; or the Photographic Artists' Co-operative Supply Association, 43, Charterhouse Square, London, E.C. J. W. G.

44.—Black Varnish.—I have some varnish which dries a dead-black almost instantaneously, and is not easily scratched off. It was obtained some years ago from Messrs. Smith & Beck.

W. B. K.

44.—Dead Black Varnish.—The varnish referred to by R. H. M. is made by Wm. Bates, Chertsey, Surrey, and is sold by all dealers in Photographic Materials. B. Sc., Plymouth.

45.—Staining Sections of Tulip and other Bulbs.—The object of D. A. will be attained by double-staining (first) in a weak solution of Iodine green for twenty-four hours, and then (second) in Beale's Carmine, or in picro carmine for a few seconds. Wash quickly; dry on best filtering paper, transfer to methylated spirit in a watch-glass, then to another of the same, and still another, then to absolute alcohol, then to clove oil; let the sections remain in each watch-glass fifteen minutes, then mount in Canada balsam or Dammar lac in the usual manner.

B. Sc., Plymouth.

46.—Air Bubbles in Botanical Mounts.—A small handy syringe for exhausting air from mounted objects is sold by most makers of microscopical instruments, and is very efficient for the removal of air bubbles. W. B. K.

46.—Air Bubbles in Botanical Mounts.—I have found no difficulty in mounting Botanical sections in Glycerine Jelly. Having sufficient Jelly on the slide, place the object in position, and cover with the cover-glass. Heat the slide over the spirit lamp until the jelly boils, and continue the boiling until the resultant bubbles seem to collect into one, and burst with a distinct cracking noise. Instantly remove the slide from the spirit lamp, place it on a cold slab, and press down the cover-glass with

a steady, even pressure. In a very few minutes the jelly cools and becomes solid, and if the process has been carefully performed, there will be no air bubbles in the mount. Having washed off the superfluous jelly, run a ring of adhesive cement round the cover-glass, taking care that there shall not be the slightest spot uncovered. In order to make it quite secure, give a second coat when the first has hardened, and finally finish off with varnish to taste.

In slides so mounted, I have not only found an absence of bubbles at the time, but none have been formed subsequently. If, however, the air has access to the jelly by the most minute spot, sooner or later it will creep in, and finally surround the object.

J. W. Fisher.

46.—Air Bubbles in Botanical Mounts.—The only art consists in first soaking the object for a few days in a solution, composed of Alcohol 1, Water 6, Glycerine 1, and in so warming the Jelly that it will penetrate the object. This I do by first dropping the warm Jelly upon the mount, and then passing the slide over the lamp or burner for an instant, to render it of equal temperature and fluidity throughout, and then laying the cover-glass gently on. If bubbles appear, and do not squeeze out with very gentle pressure, the cover must be lifted and fresh Jelly added.

J. H.

47.—Camera for Drawing Landscapes.—In a recent number (1097) of the "English Mechanic," Mr. Vincent Elsden gives a description of a very simple and economical enlarging apparatus, which will suit "Landscape's" purpose even better than the enlarging camera which he has seen. B. Sc., Plymouth.

47.—Camera for Drawing Landscapes.—It is not easy to describe one of these without a diagram. One I have consists of a lens $7\frac{1}{2}$ inches focal length, and $1\frac{1}{2}$ inches in diameter. Simple, non-achromatic, mounted in the front of a sliding case, 4 inches long by 4 in. by 3 in. The front to which the lens is fixed forms a flange $\frac{1}{4}$-inch all round, to prevent this sliding case slipping in too far. This sliding case fits accurately, and slips easily into an outer case 8 inches long. At 4 inches from the front, and extending quite to the back, there is placed on either side a piece of wood $\frac{1}{4}$-inch thick, but with a space of one-eighth of an inch between itself and the side of the outer case, made so as to insert the sides of a cover, to be mentioned directly. These pieces of wood on either side have grooves cut in them diagonally, so that a piece of looking-glass about 4 inches square can be inserted at an angle of 45° to the horizon. The top of the side pieces is furnished with a ledge, on which to support a piece of glass for the

drawing paper to rest on. At $4\frac{1}{2}$ inches from the front a cover is hinged, with sides shaped like the quadrant of a circle, so that these sink into the groove or space mentioned before. This cover is to throw a shadow on the paper whilst a sketch is being made. All the fittings are wood. J. W. G.

48.—Barbadoes Earth.—The rock is first disintegrated by boiling in water containing carbonate of soda, and the fine powder is then boiled in dilute nitric acid. After thoroughly washing, the powder is dried, and may then be sifted through sieves of fine muslin, which may be conveniently made by taking out the bottom of a good-sized pill-box, and stretching the cloth over it, forcing the ring of the cover on to hold the cloth. After sifting, the forms can be picked out readily under a hand-lens, or the sifted portions most rich in good specimens can be mounted as they are.

See "Evenings with the Microscope," in "The American Monthly Microscopical Journal." A. C.

49.—Algæ.—*Anabæna flos aquæ* and *Pandorina morum* are to be found, according to Rabenhort's *Flora Europæa Algarum*, "everywhere throughout Europe." Dr. M. C. Cooke, in his British Fresh-water Algæ, gives no localities, and leads one to suppose that all the Algæ are universally distributed wherever the proper habitat exists, a conclusion that is not borne out by any practical experience.

I have often found the above-named Fresh-water Algæ, but have hitherto failed to make a mount of them. Amongst other media, I used some of the water in which they grew, with camphor, etc., in various strengths, from the usual form to the faintest possible taint; but all in vain: in a few hours my plants had melted away.

I am much obliged for all the notices of my Query (4), but the proper medium *nondum inventum est.* H. W. Lett, M.A.

51.—Zinc Plates for Electric Battery.—Make a dilute solution of Sulphuric Acid, one part acid to eight parts water, taking care it contains no nitrous or nitric acid, as some of the very cheap acid does, otherwise you will have your zinc covered with a black deposit very difficult to get off.

Place your zincs in the acid, and when they are fairly clean, drop a little mercury on them, and rub it all over with a rag. To drop the mercury on to the plates it will be found convenient to keep about half-a-pound of it in a small bottle covered with dilute acid. A very little acid suffices; and having provided a stout glass tube about nine inches long by one-quarter inch in diameter, drawn down to a thick point with a fairly small hole at the bottom, suck some mercury into the tube, place your finger tightly on the

top, and holding the tube nearly horizontal drop the mercury on the plate in two or three patches, and rub quickly with the rag. The zinc plate should be wet with the dilute acid all the time, and be held over a plate, etc., to catch any mercury which may fall.

J. W. G.

51.—Zinc Plates for Electric Battery.—D. C. can amalgamate his Zincs with the following solution:—Put 1 ounce of Mercury into a mixture of $1\frac{1}{4}$ ounces of Nitric Acid and $3\frac{3}{4}$ ounces Hydrochloric Acid. When the mercury is dissolved, pour the solution over the zinc, which must be placed in a shallow dish, and rub the zinc all over with a piece of flannel dipped in the liquid, until it is thoroughly coated with mercury, which it soon will be; then wash it with water and put it on one side till dry, when it is ready for use. R. A. R. Bennett.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply.

52.—Coccus from Orange.—I have frequently tried, but failed, to obtain for examination under the Microscope specimens of this minute insect, and I shall feel obliged if some correspondent will kindly inform me how I am to proceed, in order to ensure success, and also the best medium for mounting them as permanent preparations. J. W. Fisher.

53.—Osteo-Sarcoma.—Will some reader tell me what is the simplest way of preparing and hardening for cutting into sections Tumours (such as Osteo-sarcoma) which contain bony spicules?

V. A. L.

54—Pygidium of Flea.—What is the best and easiest method of mounting the Pygidium of a Flea for a test object? V. A. L.

55.—Mounting without Pressure.—Will some one kindly say how Enock's and other similar slides are prepared? J. H.

56.—Silvering Brass or Copper Tubes.—Would anyone have

the kindness to let me know how Brass or Copper Tubes 20 centimeters in diameter, and 3 or 4 metres long, might be silvered in the interior by galvanic process, and, being used for the conveyance of wine, how long will such silvering last? J. D. (Italy).

57.—Food of Tadpoles.—I should like to have a quotation of Mr. Buckland's observations on the food of Tadpoles. Huxley states, that up to a certain period in their life, they crop the "aquatic plants on which they live, by means of the horny plates with which their jaws are provided."

Buckland, at some period previous to 1862, stated that tadpoles eat animal matter. Can anyone give me his very words, if not too many? J. W. G.

58.—Stone Implements.—Having a few hundred fine specimens, can anyone give me the proper mode to number, index, and catalogue such? if so, I will feel greatly obliged. The collection consists of arrow-heads, wedges, hammers, lance and spear-heads, spoons, knives, scrapers, amber, and various ornaments of clay. J. S. W. (Denmark).

59.—Oil-Immersion Lenses.—Why are these lenses such a high price? Zeiss' one-twelfth of an inch oil-immersion lens is £16, whilst his dry (about one-fourteenth of an inch) is only £4 4s. Cheaper, one-twelfth of an inch homogeneous immersions are advertised by Seibert, of Wetlar, at £10, and by Leitz of the same place at £5.

Can these cheaper glasses be depended upon? BACTERIUM.

60.—Staining and Mounting Pollen.—Will any correspondent kindly inform me how Pollen may be *stained* without destroying its natural shape and characteristic markings? And also the most suitable medium for mounting it when stained? J. W. FISHER.

61.—Cocaine.—I hear this spoken of as useful for instantaneously killing microscopical creatures, but desire more information before I try to use it. Will some member give his experience of its action, and describe how to use it advantageously? I specially desire to know if it works well on Polyzoa and Rotifera. W. H. B.

62—Holes in Live Box.—On each side of the brass plate of the ordinary live box is a small hole. I have been asked what their use is; can anyone explain? F. N. P.

63.—Hydræ and Vorticellæ.—Wishing to obtain a few Hydræ and Vorticellæ for biological work, I should be glad if any readers will say what time of the year, and where in the district of Manchester they can best be obtained. S.

64.—To separate Foraminifera from Shale.—Can anyone tell me the best way of disintegrating Shale of various degrees of hardness, separating from it the Foraminifera and other microscopic fossils it may contain. G. CREWDSEN, Kendal.

65.—Worm-eaten Wood.—Can any reader of the *Scientific Enquirer* tell me what will destroy the little beetle (Genus *Anobium*, I believe) which works such terrible havoc among furniture, popularly known by the name of "Worm-eaten?"

M. A. H.

66.—Schizonema Grevillei.—What preservative fluid is it best to use for mounting the above? Would Carbolic Acid water or Glycerine Jelly preserve the specimens in their natural condition?

H. P. FITZ-GERALD.

67.—Diatoms.—Should Diatoms be mounted dry or in medium? If the latter, is Canada balsam and benzole the best to use? Can they be cleaned by boiling in strong nitric acid?

H. P. FITZ-GERALD.

68.—Microtome.—Would some one kindly recommend a cheap, but good microtome? I am very anxious to make some Botanical Sections. MICRO.

Reviews.

WORKSHOP RECEIPTS. (Fourth Series.) By C. J. Warnford Lock. Crown 8vo, pp. vii.—495. (London: E. & F. Spon. 1885.) Price 5s.

This volume, which deserves a place on the bookshelf of every Mechanic, embraces a great variety of Handicrafts, e.g., Water-proofing, Packing, Storing, Embalming and Preserving, Leather Polishing, Cooling Air and Water, Pumps and Syphons, Desiccating, Distilling, Emulsifying, Evaporating, Filtering, Percolating and Macerating, Electrotyping, Stereotyping, Book-binding, Straw Plaiting, Musical Instruments, Clock and Watch Mending, Photography, etc. etc, It is illustrated with 240 engravings, and contains a general index to the four series.

A GUIDE TO THE STUDY OF GRAPHOLOGY, with an explanation of some of the Mysteries of Handwriting. By Henry Frith, F.S.A. 12mo pp. 126. (London: Geo. Routledge & Sons. 1886.) Price 1s.

We find here some interesting remarks with respect to handwriting; the author attempts to show how far the temperament of the writer is indicated by the handwriting; and how much the handwriting varies under differing circumstances of life. A table of Characteristics (Tendencies) illustrated by handwriting is given at the end of the book.

1,000 ANSWERS TO 1,000 QUESTIONS: Being a reprint of the Second 1,000 Questions in *Tit-Bits* Inquiry column with the replies thereto. Crown 8vo. pp. 344. (London: *Tit-Bits* Office. 1886.) Price 2s. 6d.

The Questions asked and answered embrace every conceivable subject. The book contains a large amount of useful information.

CHEMISTRY: a Manual for Beginners. 24mo., pp. 113. (Dublin: M. H. Gill & Sons. 1886.) Price 6d.

This will doubtless prove an easy Elementary course for Students who desire to gain an experimental and theoretical knowledge of the science of Chemistry. It is written in the shape of Questions and Answers.

WHITE'S NATURAL HISTORY OF SELBORNE, with an Introduction by the Rev. Hugh Reginald Haweis, M.A. 16mo, pp. 160. (London: Geo. Routledge & Sons. 1886.)

No. 5 of Routledge's World Library, a very cheap edition of this most interesting work; the price, Sixpence, places it within the reach of all lovers of Nature.

Answers to Correspondents, &c.

All Contributions SHOULD reach us by the 10th of the month, and cannot be inserted unless we receive them before the 14th.

E. W. W.—Your answers came too late for insertion in present issue, but if you will let us have the paper on the "Microscopical Study of the Earthworm," in good time, we will try to make room for it in June. If it is necessary for you to send drawings, let them be done in pen and ink *line* work.

W. Henshaw.—We regret that we cannot find room for your query in present issue.

M. D.—You cannot do better than write to Mr. Hy. Vial, 9, St. Lawrence Green, Crediton, Devon, for Pathological and other Slides.

F. W. Steel and F. N. P.—Other correspondents had previously answered the questions to which you have so kindly replied.

T. S.—Please let us have your paper.

We beg to thank the following for their contributions, and hope to find room for them in our next:—E. W. W., C. J. W., G. H. Bryan, A., H. F. J., A. L., Z., W. Short, W. Henshaw, V. A. L.

Sale and Exchange Column.

Will give good exchange of well-mounted Micro Slides for vols. 3 and 4 of *Illustrated Science Monthly*.—Rev. H. W. Lett, M.A., Aghaderg Glebe, Loughbrickland, Ireland.

I still have a few good slides of Fish Scales to exchange. Approval to be mutual.—Rev. H. W. Lett, M.A., Aghaderg Glebe, Loughbrickland.

CHROMOLITHOGRAPHS.—I shall be glad to sell seven large Chromos, copies of the "Cartoons of Raphael." Full particulars of size, subjects, etc., on application.—A., care of Editor.

KIRBY AND SPENCE ENTOMOLOGY.—4 vols. in original paper boards, outer leaves slightly damp-stained. Price 15s.—A., care of Editor.

Wanted, Book on British Seaweeds, with good illustrations. Will give in exchange Microscopical Slides of named Diatoms, etc. Will send list.—M. Farhall, 7, Lorna Road, West Brighton.

Micro Slides for exchange—chiefly Diatoms.—H. P. Fitz-Gerald, North Hall, Basingstoke.

Foraminiferous Sand and Diatomaceous Earth to exchange for other Micro material.—H. P. Fitz-Gerald, North Hall, Basingstoke.

Worked Flints, Paleolithic and Neolithic, in exchange for Fossils. Apply by letter to J. French, Felstead. I would pay all charges.

Microscopical Slide Labels for Animal and Vegetable Kingdom, toned paper, 6d. per 100; samples of 33 kinds, 2d.—Chas. Watkins.

Insects in Spirit and Dry, selected for Mounting. New List ready.—Chas. Watkins, King's Mill House, Painswick, Gloucestershire.

The Scientific Enquirer.

JUNE, 1886.

A Plea for the Collection and Study of the Coleoptera.

By a Practical Hand.

THE number of those who collect British Lepidoptera is very much greater than that of those who collect any of the other orders of insects. Many reasons may be given to account for this ; one, no doubt, being the large size and attractive appearance of the gaily coloured butterflies, compared with the often inconspicuous colour and small size of other insects, such as beetles. I, however, feel sure that the chief reason is that students are unaware of the richness of the field which, owing to the great variety of insects, lies open for their investigation, and the many advantages which attend their collection. A few of these advantages I will attempt to point out, in the hope that I may induce some lovers of nature to take up the collection and study of our British Coleoptera.

1.—The number of British species, and almost endless variety of their form and structure.

2.—Their nearly universal distribution, both as to time and locality.

3.—The ease with which they may be captured and preserved.

4.—The small amount and inexpensive nature of the apparatus required.

5.—The ease with which they can be set.

6.—Their indestructibility compared with other insects.

7.—The literature on the subject.

The number of species known to inhabit Britain, and considered distinct, is at the present time about 3,250, and is considerably more than that of any other order of insects. The Coleoptera vary in size from the Stag Beetle *(Lucanus cervus)*,

which is about two inches in length, to the *Trichopterygidæ*, some of which do not measure one-fiftieth of an inch, and they exhibit almost every conceivable variety of form and colour, according to their food, habits, and so on. For instance, the *Geodephaga*, which subsist by preying on other insects, not only have their mouth organs adapted for seizing and tearing their victims, but have long legs, enabling them to run with great rapidity. These beetles, when alarmed, take refuge in flight, and, owing to the swiftness of their movements, often make their escape, much to the annoyance of the collector. Others, from having short legs, and being capable only of slow movement, would have no chance of escape, if it were not for the power they have of feigning death; and to enable them to do this, fold up their legs and antennæ in grooves in a very wonderful manner. There is also a great variety in the construction of these appendages, the beetles *Byrrhus* and *Hister* being good examples. The name of the last is derived from this habit, as the word *hister* means an actor. Some think that this is not the effect of the will of the insect, but the result of a catalepsy, arising from fear. Such may be the case, for some of those beetles which have not the power of packing up their limbs extend them and remain rigid in this way. It is, however, worthy of note that it is only those which have no chance of escape by flight that act thus.

The Elaters, or "Skipjacks," have a still more curious way of making their escape. When a Skipjack is frightened it falls to the ground, always on its back, and from this position would, owing to the shortness of its legs, have no means of escape, were it not for the spine of the sternum, which fits into a notch in the mesosternum, and the power the beetle has of straining back until the spine is liberated with a jerk (something in effect like the spring of the wooden toy jumping frogs), which propels the insect upwards high enough in the air to enable it to take wing and fly off. Others, as the *Haltica*, have their hind legs formed for leaping. *Phyllotreta nemorum*, sometimes called the Turnip Flea, is an example. The Dor Beetle (*Geotrupes*) is another instance of the modification of the legs, but for a different purpose. In these beetles the legs are immensely powerful, the front pair being constructed for digging. We may see how efficient they are from the fact that one of these beetles will in a single night dig a hole in the ground some eight or ten inches in depth, and place in it a ball of dung containing one or more eggs. Now, in proportion to its size, this feat is as if a man with no tools but his own hands were in the same time to dig a hole the size of his body, and 50 or 60 feet deep. In this way I might go on citing innumerable instances, as, for example, the swimming legs of the water beetles, etc. In fact, to describe the various organs, such as the mouth,

wings, antennæ, etc., with any completeness would occupy a volume. Then, again, there are the sexual differences, both the ornamentation of the males and the modification of various organs for the purpose of prehension.

Beetles are of nearly universal occurrence, as from the fact that many of them live through the winter in a torpid state; they may, by careful search, be found at all times of the year. Of course, it is more difficult to find them in the winter when they are hidden away in cracks and crevices, under bark, stones, etc.; but even in the winter, garden rubbish, the *debris* under haystacks, moss, and tufts of grass at the bottom of walls, if shaken out, and the siftings taken home and carefully looked over, will produce many species, some of which will be found to be rare. The summer, or from the middle of March to November, is undoubtedly the best time for collecting them; at this season Nature may be said to swarm with them. They may be found by searching under stones and clods, by sweeping and beating, or by placing baits for such as the Burying beetles, and Water-beetles may be obtained from every pond or ditch with a suitable net. The dung of horses, cows, and sheep teems with them, and in this way may be found the whole of the genus *Aphodius*, of which there are forty-four species, the *Copridæ*, *Geotrupidæ*, and hosts of *Brachelytra*, both large and small, and many others, They are to be found nearly everywhere, for cellars and outhouses even in towns often have beetles peculiar to them. I do not mean cockroaches, which are not beetles at all; but where these abound, there may generally be found beetles which prey upon them.

The lepidopterist must exert himself if he wishes to collect butterflies with any success, as in chasing a rare insect over hedges and ditches, and very often not catching it after all. This may be very good exercise and great fun, but it is not suited to every constitution, and particularly to that of those of us who are advanced in life. Again, if the lepidopterist wishes to get a good collection of moths, he must spend many nights in the woods with lantern and treacle pot, often getting wet through, for it is just in this sort of weather that the best things are caught. The coleopterist, however, can place his apparatus in his pockets and go for a quiet stroll over the fields or along the lanes, as he chooses, and, without any bodily exertion, get plenty of specimens. Of course, for those who wish, there is more active work to be done, such as sweeping, beating, and so on. I do not wish it to be supposed for a moment that I deprecate the collecting of Lepidoptera. On the contrary, I commend it as a pursuit having many advantages, particularly for the young; and, as they generally collect only the Macros, that is the larger species, entirely omitting the *Tortricina* and *Tineina*, they do not require a microscope

to view them, neither have they to contend with those nice specific distinctions which are so puzzling in most of the orders of insects.

The apparatus required for collecting beetles is very simple. A laurel bottle, two tube bottles, two or three small bottles, some strong homœopathic pillule tubes, and a few strong pill boxes (those in nests of three are the best), a strong ring net, which, if made of cheese-clothing, will do both for sweeping and for a water net, a strong jack-knife, or a small-pointed garden trowel, and, lastly, a bag for bringing home shakings or moss for careful examination. The above forms a very good outfit for a day's collecting, except in special cases, such as working a forest, when a beating net would be required ; but even in this case an umbrella makes a very good substitute. The Rev. W. Kirby used always to carry in his pockets a few bottles and a newspaper, into which he beat the hedges and herbage of the banks when going about on his ministerial duties ; and in this way he collected and studied an immense number of insects.

Beetles may be properly set much easier than any other insects, and in nearly all cases no setting boards are required. It is only requisite to kill all those which are not in laurel in boiling water, then to take them out on to blotting-paper, and to set them on any old soiled card with ordinary glue, which, of course, must be kept warm, either in a small glue pot or in a child's food-warmer. In this state they can be kept for any length of time, until an opportunity occurs for examining and resetting them on the finest Bristol-board, which is a very simple affair. Having the card and gum tragacanth ready, it is only necessary to drop the beetle and card to which it is attached into warm water, when the insect will float off, and may be taken out, dried with a piece of blotting-paper, and placed in position on the new card. Or, if away from home, or for any other reason, it is not desirable to set them at once, it is only necessary, after drying them on blotting-paper, to place them in the laurel bottle, in which they will keep for two or three weeks ; in fact, they set better after being in the laurel bottle two or three days. The small ones, if not all the others, should be placed in a muslin bag before they are put in the laurel bottle.

As beetles are encased in an armour of chitine, most of them may be handled without injury ; for, with the exception of a few species, there is no fear of spoiling their beauty, as is the case with the Lepidoptera, which are so easily damaged that it is almost impossible to get quite perfect specimens, except by breeding them from the larva or pupa stage. There are a great many beetles which are hairy, downy, or otherwise clothed ; but this clothing is not of a very delicate character, except in the case of

the Green Weevils and some others, which require the greatest care in collecting and setting, or they will be hopelessly disfigured. Beetles undoubtedly keep better in the cabinets than any other insects, and old ones, if not destroyed by mites, can be cleaned and their colours revived.

It is not of much use to collect any insects unless we can find the names of them; this is obviously the first step towards a knowledge of their habits, etc. For this purpose books are necessary, and on this point the Coleoptera must certainly rank second only to the Lepidoptera. For studying beetles two books are indispensable—first, "Rye's British Beetles" (Lovel Reeve, London, 10s. 6d.). It contains 16 coloured plates of beetles, and all the information that is absolutely required to be known of their structure, and an account of all the important families. The second is "Cox's Handbook of British Beetles" (Janson, London, 2 vols., 17s. 6d.). It contains a description of every species known and described up to 1874. With these books the student will, with a fair amount of application, be able to find the names of all the larger beetles and some of the smaller ones; but he must not expect to solve doubtful points, specific varieties, or even to determine the species of some of those where the number of species is large and the difference very slight. This is a knowledge that is only to be gained by study and experience; in fact, there are still doubtful points which all the coleopterists have hitherto been unable satisfactorily to settle. It will be seen that no one can expect to become a coleopterist all at once, but patience and perseverance will overcome every difficulty, and the study then becomes a real, life-long, and never-failing pleasure, which may be dropped or resumed at any time as business or other occupation may require.

"And whenever the way seemed long,
Or his heart began to fail,
She would sing a more wonderful song,
Or tell a more marvellous tale."

Short Papers and Notes.

Drying Plants.

ON this subject S. H. Smith, Ph.C., wrote in the early part of last summer to the *Pharmaceutical Journal* to the following effect:—

"I am a young and inexperienced botanist, but

having obtained some remarkably good results in preparing plants by the following method, I should like to lay it before my brother pharmacists to obtain their opinions. Two large square boards are provided, each having two cross pieces, broadly grooved, to allow straps to pass round. On one of these cotton wool in a thick pad is placed, the plants carefully arranged on it, and covered with a second pad, on which more plants are spread, and so on. At last the second board is placed, and the whole strapped tightly together, and allowed to remain for four or six hours. The straps and top board are now removed, and the remainder of the pile placed on a rack over the kitchen range. In this way the whole is quickly dried without moving the specimens, the top board is then replaced, and the whole strapped up again and the process repeated. In this way plants are very quickly finished ready for mounting. Of course, this method is not applicable to gorse, etc., etc. In some cases it is found useful to place the plants between bibulous paper before inserting between the cotton wool, but these exceptions are rare with British plants ; the colours are wonderfully preserved by, and the most delicate specimens yield to, this treatment."

Refractive Index of Certain Liquids.

The refractive index of a few liquids is as follows :—Water, 1·336 ; alcohol, 1·372 ; muriatic acid, 1·410 ; nitric acid, 1·410 ; sulphuric acid, 1·434 ; olive oil, 1·470 ; oil turpentine, 1·475 ; cajeput oil, 1·483 ; castor oil, 1·490 ; beech nut oil, 1·500 ; balsam copivi, 1·528 ; Canada balsam. 1·549 ; oil of cloves, 1,535 : oil of aniseed, 1·601 ; balsam of tolu, 1·628 ; oil of cassia, 1,641 ; sulphuret of carbon, 1·768.—*Scientific American.*

The Detection of Frauds in Silk or Woollen Fabrics.

Ladies are frequently (if not always) interested in knowing whether their purchases of silk or woollen goods are really what they are supposed to be. The question, with the help of the microscope and a little chemical knowledge, is not very difficult of solution. Thus, a piece of any woollen or silk goods may be tested by boiling a small fragment in a test-tube, with some strong solution of potash (the Liquor Potassæ of the Pharmacopœia). The fibres of wool (hair) or silk are soluble in this liquid, whilst cotton or flax fibres, with which they are most likely to be adulterated, are not so, and will be left in the tube. A microscopical

examination will identify the nature of the fibres. If the fabric be undyed the wool will be coloured, apart from the cotton, at the moment of its solution in the alkaline liquid by the addition of a few drops of Goillard's Extract (solution of subacetate of lead). The decomposition of the wool (animal substance) liberates sulphur, which is one of the elements of albuminous (animal) structures. The fibres of the wool that are not dissolved will be dyed of a deep brown by the sulphide of lead which is then formed upon them, whilst any cotton or flax will remain uncoloured. A low power of a microscope, or an ordinary pocket lens, will at once demonstrate the fraud. The transverse markings of hairs will serve to distinguish them from the straight or twisted fibres of flax, jute, or cotton. Cotton is the material most frequently used for the adulteration of wool; jute or flax are employed to give a factitious quality to silk.

W. B. KESTEVEN, M.D.

Enfield, Middlesex; April, 1886.

Caligus.

Those who wish to study this parasitic crustacean can get plenty of specimens from the salmon and other fish now (May) lying on the fishmongers' stalls. They are known by the elegant name of "fish lice."

H. E. FREEMAN.

To Examine Micro Fungi.

To observe *Puccinia graminis*, strip off lengthwise a small portion of the straw, and view as an opaque object, with half-in. object glass and a low eye-piece. It will appear studded with stalked fruits of an oblong or pear-shaped form, crowded together in patches. Amongst them will be found intermixed spores of *Uredo*, which are globular, and of a reddish colour. To trace out the individual structure of the fructification, scrape off a portion of cuticle, so as to obtain a transparent object, and view this with a higher power. A still further study is made by separating a portion of the true Puccinium by means of a needle; moisten the specimen, place it between slips of glass, and view as a transparent object.

VAL.

Interesting Experiment for the Microscope.

The embryo grain of wheat, at the time of blossoming, being carefully taken out of the husk, will be found to have a small downy tuft at its extremity, which, when viewed in a microscope, greatly resembles the branches of thorn, spreading archwise, in

opposite directions. By expanding a few of the grains and selecting the most perfect, a very pretty microscopic object will be obtained for preservation. V. A. L.

To Remove Stains or Discolorations from Paper.

Printed paper, in books or engravings, may be whitened, when stained or discoloured, by first being damped with pure, clean water, then dipped into a diluted solution of chloride of lime; withdrawn from the latter solution, the stained portions must be passed through water mixed with hydrochloric acid. Lastly, the paper so treated has to be passed through pure water until every trace of acid is removed. The process may be still further improved by dipping the paper into a weak solution of antichlor, and again thoroughly washing in clear water before finally drying. Only rare and valuable books are worth the trouble of the prolonged treatment, which, on account of the very fragile nature of the paper, requires the utmost care and some skill in handling. In the great majority of cases the stains may be obliterated by simply exposing them, after being moistened, to the fumes of burning sulphur, and afterwards passing the portions treated through pure water. Under all circumstances care must be taken to prevent injury to the paper by rough or hasty handling.—*Bos. Journ. Com.*

Tannin Reagent.

The other day, while experimenting with the microscope, I dipped my tube on some scum, the result of the decomposition of sea anemones. I found numerous *Paramæciæ Bursuriæ* flying about, with their cilia in quick motion. I tried several reagents in order to see the true length of the cilia, but none were successful till I tried "tannin dissolved in glycerine." The result is all that could be desired. This reagent has the effect of stiffening the cilia and making them appear in their true length. A.

Frozen Fish.

Several winters ago I purchased in one of the Hartford, Conn., fish markets, three frozen pickerel, and I carried them home at night. They were frozen perfectly hard and stiff. I placed them in a large tin pan, and filled it with cold water. In the morning my attention was attracted by a flopping at the pan, and I found one of the fish was splashing about as lively as when he first took the bait.—J. H. L., in *Scientific American.*

Answers to Queries.

11.—Black Varnish.—My experience of Black Japan for making cells is that it inevitably in the course of time chips off, and the mount is ruined. I have seen a great many slides spoiled in the boxes of the P.M.S. owing to this, and I have frequently put a note in the accompanying books warning members to mount their objects with something else than Black Japan as the varnish for fastening cells and covers. Mr. Topping must use something else mixed with his Black Japan if his cells last many years. I recommend Black Japan to be used merely for ornamental purposes when finishing off the slides.

H. W. Lett, M.A.

29.—Moisture in Dry-Mounted Diatoms.—Beads of moisture are so frequently found on the slides or covers of dry mounts that many microscopists have almost discarded dry mounting. This effect is supposed to be due to dampness within the cell ; this may be one, but it is not the only cause. For similar drops may often be found on the *outside* of the cover in balsam mounts, but being easily wiped off are not noticed. Also, if a "cloudy" slide or cover be laid in a dry place the drops still remain, and, if heated, small *crystals* apparently are left, and these again deliquesce on cooling. For opaque objects the only remedy I know is to use either *uncovered* card cells (which are very useful for Foraminifera) or pill-box cells, which allow of the cover being removed and wiped. The latter may be made by attaching one ebonite cell to the slide, and a larger one, which will just fit over it, to cover it and to form a lid. If the moisture is on the slide of V. A. L.'s mount, and the diatoms are on the cover, he had better remount it on a fresh slip. He should make a ring of asphalte on a *clean* slide, and when it is *dry* remove the cover with the diatoms by heating slightly, warm the new slide, and press the cover down into the varnish ring. In this way the danger of dampness will be removed, and any further cloudiness must be due to some other source. G. H. Bryan.

30.—Coal.—Mr. R. A. R. Bennett (p. 72) does not seem to be aware that the subject of preparing sections of coal for the microscope was discussed by several writers in *Science Gossip* for 1882, and it was there stated by Mr. F. Kitton and others that the "Micrographic Dictionary" paragraph was misleading, and that it was utterly impossible to make and bleach sections of the ordinary coal of commerce. I wonder has your correspondent

ever tried to cut a thin slice off a lump of coal out of the coal-scuttle? I wish he and others would really try the experiment and faithfully communicate to your columns the result. However, there is another substance, known as lignite coal, which possesses a partially woody structure, not being completely mineralised like the common or anthracite coal, and of this it is quite easy to cut sections. It is time that the editors of the "Micrographic Dictionary" eliminated what Mr. Kitton describes as a "useless formula," or else corrected it so as to apply only to the lignite, which is similar to the brown German coal that sugar refiners use in purifying syrup. H. W. LETT, M.A.

30.—Sections of Coal.—I fear the answer to this query (p. 72) will lead to much waste of time and temper, as it has done in the past. True coal does not get soft in a solution of carbonate of potash, and I doubt if anyone has ever cut a thin section showing the structure, with a razor, either before or after maceration in any fluid. The beautiful sections showing the vegetable structure, prepared by Norman and others, are cut from nodules of coal which have been hardened by the infiltration of lime. The ordinary "black diamonds" of commerce are too much decomposed to permit the structure to be made out. The instructions given in the "Micrographic Dictionary" apply to the *lignites*, of which there are many varieties, jet, or black amber, being one. Lignite, though a poor kind of coal, is largely used in France for fuel. H. E. FREEMAN.

38.—Dissecting Small Insects.—Insects intended for dissection must never be allowed to dry, and if they cannot be treated at once, should be preserved in dilute glycerine, dilute acetic acid, or weak spirit, according to what is required of them afterwards. Kill the insect with chloroform, or in the cyanide of potassium bottle, and examine, if not too large, under the microscope; detach all external appendages by means of a knife, scissors, or forceps. The carcase must now be pinned down in a trough, or fixed to a bedding of white wax, by warming a spot with a hot iron. The integument must now be carefully slit up with a fine pair of scissors, then raise the chitinous skeleton with forceps, and clear away the attachments with the aid of a blunt needle and a spear-headed instrument (a glover's needle, sharpened on Ayr stone, is very useful), when, if tolerably well done, the organs will be seen *in situ*. Now leave the subjects in equal parts of glycerine and water for about 12 hours, after which treatment the organs may be readily dissected. Dilute alcohol is useful when the nervous system is dissected; prolonged immersion hardens nerve fibres. In such insects as flies, crickets, etc., the folds of the abdomen can be pinned back. I prefer to

cut away the integuments of smaller insects. They may be imbedded in wet plaster of Paris, which must then be allowed to set. Always make dissections under water. Insects may also be boiled in Liquor Potassæ, which dissolves the *internal* organs, then bleached and mounted. By this process the mouth organs may be well shown. V. A. L.

39.—Scientific Names.—The *Student's Natural History*, by Dr. Wm. Baird (published by Chas. Griffen and Co.), is a most useful book to naturalists whose libraries are limited. It is in dictionary form, treats of the animal, vegetable, and mineral worlds, and gives most of the Greek roots, with the English rendering. It can be had at Weldon's, Great Queen Street, W.C., price about 7s. I think it was published at a guinea in 1863.

H. E. FREEMAN.

40.—Mounting Fish Skins.—To the information already given on this subject I would add a caution about the pressure to which they are submitted while being dried. If too much, many of the scales will become smoothed, and lose the various corrugations that constitute their chief beauty. I have found it best to place the skin, when well washed from all trace of potash, between pieces of note paper, which are then placed between bits of glass, and secured by tying a string, not too tightly, round all. I prefer string to rubber bands. The paper should be changed twice during the first twenty-four hours. The same method answers for separate scales, in preparing which it will be necessary to take great care not to allow one species to get mixed up with another. A remarkable instance arising from omission of this, occurs in one of the earliest volumes of *Science Gossip*, where are excellent engravings and notes on the scales of most of our common fishes.

H. W. LETT, M.A.

40.—Mounting Fish Skins Dry.—Wash well with short paint-brush in soda and water, finishing with distilled water, so as to remove all foreign matter ; then dry by placing under bell-glass, or, better still, the receiver of an air-pump, containing a saucer of sulphuric acid. H. F. J.

41.—Sections of the Earthworm.—It would take up too much space to give an intelligible answer to this query. We should have to ask the Editor's permission for space for a short article to answer it fully. E. W. W.

[We are always willing to give reasonable space to any subject of general interest.—ED.]

44.—Dead Black Varnish.—Methylated spirit, 10 ounces; orange shellac, ½ ounce; lamp black, one ounce. Dissolve the shellac in the spirit, then rub the lamp black very fine, and add the liquid gradually. I have always found this to answer.

E. W. W.

45.—Staining Sections of Tulip and other Bulbs.—This can be done the same way as wood sections already described in this Journal; but they do not require to be left so long in the dyes.

H. F. J.

46.—Air Bubbles in Botanical Mounts.—If the cell is well washed out with liquid glycerine, and the object well soaked in the same before mounting, there should be no air bubbles. If they appear, slightly raise the cover, and add a drop more of the medium, leaving the slide sloping, so that the drop may run in and take the place of the bubble; then wipe away the superfluous medium and ring with gold size. H. F. J.

46.—Mounting Botanical Sections in Glycerine Jelly.—The section in the jelly should be slightly warmed for a few moments before covering it. The cell should be quite full of jelly when about to cover it, and the cover must be pushed on from the side, so as to gradually cover the section and exclude the superfluous jelly without permitting any bubbles to get in. If the cover is simply placed on the top of the section bubbles will probably appear. The superfluous jelly can be afterwards wiped off with a cloth. The edge of cover must be cemented to the cell with brown cement, gold size, or Brunswick black. When this is dry the slide is complete. The slide should be kept hot till the cover is on, to prevent the jelly from solidifying.

V. A. L.

48.—Barbadoes Earth.—First process: Procure a large glass vessel, with 3 or 4 quarts of water; a new tin saucepan, holding 1 pint; two narrow precipitating glasses, holding 10 ounces each. Take a lump of earth, dry, and break it into rather small fragments. Put 3 or 4 ounces of washing soda into the tin saucepan, and half fill it with water. Boil strongly, and having thrown in the earth, boil it for half an hour. Pour nine-tenths of this into the large vessel, and gently crush the remaining lumps with a soft bristle brush. Add soda and water as before and boil again; pour off the liquid into the glass vessel, and repeat until nothing of value remains. Stir the vessel with ivory spatula, let it stand for three minutes, then gently pour off nine-tenths of the contents, when the shells will be left only partially freed, like sand. Second process: Put common soda and water into the tin sauce-

pan as before, and place the shells in, and boil for an hour. Transfer to large vessel as before, and, after allowing it to stand for a minute, pour off. Each washing brings off a kind of flock, which seems to be skins. Third process: Put the shells in a precipitating glass and drain off the water until not more than half-an-ounce remains. Add half-a-teaspoonful of bicarbonate of soda, and dissolve, then pour in gently one ounce of strong sulphuric acid. This liberates the "flock," etc., and leaves the shells beautifully transparent. Wash well with water to get rid of the salts. Some of the large shells are destroyed, but none that are fit for microscopic use.
V. A. L.

50.—Colours for Photo Transparencies.—Has A. C. tried mixing a little ox-gall with the oil paints? It has the desired effect with water-colours.
H. F. J.

51.—Zinc Plates for Battery.—The plates should be immersed in the following solution:—sulphuric acid, 1 ounce; water, 10 ounces—until clean; about five minutes is required. Then a few drops of mercury must be put on the plate and well rubbed in.
E. W. W.

52.—Coccus from Orange.—This insect (*Lecanium hesperidum*) may be found in abundance on the under side of leaves of orange-trees, especially if the tree is not in very good health. I have read of it being found on the orange fruit which is imported into England from Spain and elsewhere. A good account of the "Coccidæ" family will be found in the *Entomologist's Monthly Magazine* for December, 1885, March and April, 1886, by Mr. J. W. Douglas. If the writer of question No. 52 should find a difficulty in procuring live specimens of the insect, I shall be happy to assist him on application. Balsam dissolved with benzole answers for mounting the insect.

ALBERT F. MORGAN.
Ville Nova de Gaya, Oporto, Portugal.

53.—Osteo Sarcoma.—To prepare and harden for cutting into sections I would recommend to soak it first in a very thick solution of gum arabic in water, then harden in alcohol. Cut under alcohol, and put the cuts directly from the razor into warm water, which will take away the gum

Plymouth. B.Sc.

53.—Osteo Sarcoma.—Some time ago I had an Osteo Sarcoma tumour, taken from the forehead of a woman, sent me by a medical gentleman, to cut into sections and mount for him, which I succeeded in doing, by first dividing into small pieces and soaking

them in a solution of hydrochloric and chromic acids—$2\frac{1}{2}$ per cent. of the first to $\frac{1}{4}$ per cent. of the last—made in large quantity, and frequently changed. The spicules softened in about a week, when the pieces were transferred to methylated spirit, to harden the tissue. They are best cut in a freezing microtome, using a plane iron, the force of which will easily go through softened bone, and is better than any knife or razor for cutting animal tissues.

Crediton. HENRY VIAL.

59.—Oil Immersion Lenses.—The reason why Zeiss's immersion lenses (not *oil* immersion, as "Bacterium" writes, because, although castor-oil is a favourite medium in this country, distilled water is more used abroad, where Zeiss's lenses are best known) are so much higher in price than the non-immersion, is the extra labour and care bestowed on them, and if the price quoted—£16 for a one-twelfth—is for an objective, with the *new* glass just brought out, through experiments at the instance of the German Government (who awarded him £1,000 some years ago to prosecute trials in that direction), it will be splendid value for the money. As Zeiss sometimes takes three years to complete an order, I would recommend "Bacterium" to get in the meantime a Hartnach sixteenth, £8; a Crouch fifteenth, £8 8s.; or a Wray fifteenth, £7 10s. I know nothing of Seibert, but Leitz does nor come up to those I have named.

Plymouth. B.Sc.

60.—Staining and Mounting Pollen.—Place a small quantity of the pollen on the centre of the slide; a small drop of staining fluid (anilin dissolved in alcohol) is placed upon it. Then wash by dropping on pure alcohol until all traces of sediment, or of stains upon the glass among the pollen grains, are washed away. Wipe clean with a dry cloth drawn over the end of a pointed stick, turning the slide rapidly on the turn-table. When thus cleaned and quite dry put on a drop of spirit of turpentine, and apply balsam, and cover. A few kinds of pollen are distorted by the action of alcohol. Some of these can be stained by the use of an ammoniated solution of anilin. Those that will not bear this solution must be mounted unstained. V. A. L.

61.—Cocaine.—Place a number of the animals in a watch-glass with 85 minims (5 c.cm.) of water, when they will become fully expanded. A $\frac{1}{2}$ per cent. solution of chlorohydrate of cocaine is added drop by drop until it forms a fifth part of the entire fluid. Half a c.cm. ($8\frac{1}{2}$ minims) of the drug is then added, and the animals become so completely fixed that it is necessary to touch them very roughly with a needle in order to induce them to

contract; in ten minutes' time they will be quite dead, and can be mounted as usual. This reagent is superior to all others, as it requires no delicate manipulation. It is not yet certain whether its effects upon marine animals is equally strong in all cases. A saturated solution of salicylic acid is very useful for mounting and slightly staining Hydroids, Volvox, etc. V. A. L.

65.—Worm-eaten Wood.—M. A. H. will find the injection of a solution of corrosive sublimate, or of carbolic acid, effectual for the destruction of the wood-eating beetle (the *Ptilinus pectinicornis)*. Either of these substances must be diluted and very carefully injected, as each will destroy or spoil any varnish or polish on the surface of the wood. It is not uncommon for articles of furniture to break down, scattering the dust and *débris* of the destructive operations of the beetle or its grub, which will have reduced the woodwork to a hollow case of outside wood and varnish. P.

67.—Diatoms.—The majority of mounters use, I believe, Canada balsam and benzole, though some prefer tolu in chloroform. By mounting in medium, unless it be highly refractive, the sharpness of definition is, under some circumstances, partially lost. Thus, the striæ of *Pleurosigma formosum* are more easily visible dry than when mounted in Canada balsam. I have generally found that boiling the Diatoms in sulphuric acid till it gives off white vapours and the earthy matters are carbonised, is better than the nitric acid process. A few pinches of nitrate of potassium will completely bleach the material, and the sulphate of potassium thus formed can be easily washed out.

ALFRED W. GRIFFIN.

68.—Microtome.—"Micro" asks for a "cheap," but good, microtome. "Cheap" is a relative term; good is positive. I can strongly recommend a positively "good" microtome, made by A. B. Chapman, Ipswich. The price I consider relatively moderate (if I remember correctly, 30s.). Some things are dear at any price. W. B. K.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply.

69.—Insect Puzzle.—Here, on the Cotswold Hills, during the autumn of 1884, I found attached to stems and blades of grass numerous snow-white elliptical cocoons from ⅜in. to ⅝in. in length. The outside silk of these exactly resembles fine cotton wool, but the inside is of a finer texture. From these cocoons I bred from April to July, 1885, specimens of a Dipteron and two kinds of Ichneumons, besides thousands of a tiny, pale brown mite. I am curious to know which is the host, or if I have bred it. As these cocoons are not uncommon, perhaps some reader interested in the Diptera or Hymenoptera may have worked out these life histories, and will kindly give the name of the insect whose larva spins these cocoons. I shall be happy to send specimens of the insects, also cocoons to anyone who will endeavour to name them.

King's Mill House, Painswick. CHAS. J. WATKINS.

70.—The Weather.—Everyone says we have had a wet winter, a very cold winter, and a protracted one. Can any of your readers illustrate this by giving particulars of the rainfall and the temperature, etc., as compared with the last and with former years? In 1885 I first heard the thrush on February 1st. When did it commence singing this year? Have birds generally been any later in singing or pairing this year? In short, has the lengthy winter affected them at all? Those of your readers who observed the time when the leafing of the various trees and shrubs commenced in 1885 will, perhaps, let us know how this compares with the present year.

W. HENSHALL.

71.—Picro-Carmine.—Does balsam and benzole affect sections stained with aniline dyes and Picro-Carmine, if the above is used as a mounting medium? V. A. L.

72.—Diatoms.—What is the best bleacher for Diatoms to be used when boiling? O.

73.—Poisons of Fungi.—Are there any books or papers in scientific magazines which give a full account of the nature and properties of the poisons which are found in fungi? The subject appears to be involved in much difficulty and uncertainty. Some species appear to be poisonous in some countries and not in others; *e.g.*, the Fly-agaric is eaten in Russia when steeped in vinegar, and our common mushroom is considered unwholesome in Italy. Perhaps the poison may reside in the juice, and can be extracted or neutralised by steeping in vinegar. C. H. W.

74.—Night Skies.—I have observed that very commonly a clouded dull sky during the daytime is followed by a clear, cloudless, and star-lit sky at night—hence the frosts which so frequently at this time of the year damage vegetation that has been fostered by the warmth and showers of the daytime. This variation occurs and may be noted at all seasons of the year. Can any of your readers give an explanation in accordance with the laws of meteorology? E.

75.—Dead Birds.—During the winter season a vast number of small birds must inevitably die from cold and starvation, and yet how rarely are their dead bodies seen! Can any of your readers suggest what becomes of them? Migration will, of course, account to a very large extent for their diminished numbers in the winter season, but still vast numbers are left which are not of migratory habits. S.

76.—Photography.—While travelling I was unfortunate enough to crack the back combination of my wide-angle rectilinear lens. The crack is a perfectly clean and straight one, and extends from the outside as far as the centre. It is, therefore, only half across the lens. I feared it would spoil the lens, but I cannot see any difference either on the focussing screen or on the plates after development. It must, however, weaken the picture slightly. I presume a simple accident to the lens itself is out of focus of the lens, and consequently does not do much harm to the picture. Can any reader explain satisfactorily?

JNO. E. FAWCETT.

77.—Atlantic Ooze.—I have a small piece of ooze from the Atlantic (1,600 fth.) *Challenger*, and should be glad if any reader will tell me how to prepare and mount it. It will *not* stand boiling in any acids to clean, and shaking up by heating in a test-

tube does not help. As the piece from this particular locality is very small, I should like the most reliable method. V. A. L.

78.—Micro-Photographs.—I have several of these, on very small beads of glass, and should be glad if anyone will give method of mounting them. I was told to mount as microscopic slides in a ring with Canada balsam and benzole, but it seems to me to be a rather doubtful way. I have generally had them photographed on the slip. V. A. L.

79.—Photography.—In Burton's tables of exposures I have not seen it stated whether they are calculated for sunshine or diffused light. I think it would be interesting if someone would explain.

JNO. E. FAWCETT.

80.—Renal Tube-Casts.—Can any reader inform me what is the best method of staining and preserving renal tube-casts so that they will keep? A.

81.—Canada Balsam.—Will some practical reader kindly inform me how to thin Canada balsam with benzole without darkening the balsam in colour? I have lately spoilt two lots of balsam, and should be glad to know how to avoid future mishaps.

F. R. BROKENSHIRE.

82.—Sieve Tubes.—I have a slide showing some sieve tubes running radially to join two vertical columns of these structures. Is not this very unusual? I find no mention of it in Sachs or De Bary. A. W. L.

83.—Cyclops.—Would some reader give me directions for mounting a Cyclops? MAC.

84.—Bleaching Insects.—Would some one give me the best recipe for bleaching insects, and making them transparent for micro-mounting? MICRO.

85.—Diatoms.—During the ensuing season I intend taking up the study of Diatoms. Will some diatomist inform me what is the best book for me to commence with, and if the study can be profitably pursued with a Swift's best English $\frac{1}{4}$-in. objective and "D" eye-piece?

J. BENJAMIN BESSELL.

86.—The Microscope in Class Demonstration.—I am teaching a large class of children the elements of botany, and, having only two microscopes at my disposal, find a great difficulty in obtaining individual inspection of cells, tissues, etc. I have

heard that an ordinary monocular microscope can be so arranged, by means of simple apparatus, as to throw a picture of any object upon a screen large enough for a number of persons to see it. Can any reader of the *Enquirer* inform me how to arrange the microscope, or where to get the apparatus necessary?

F. W. C., Peckham.

87.—Asphalte Varnish.—As very conflicting opinions have been expressed in your valuable paper in reference to asphalte varnish—for instance, those expressed by B.Sc., Plymouth, and Mr. Deans—would these gentlemen, or other correspondents who have used it for any length of time, kindly express their opinions on the subject *more fully?* MAC.

Reviews.

WISE SAYINGS selected from the Writings of Great Men. By Percy Lund. 16mo, pp. 64. (Ilkley: P. Lund and Co. London: L. N. Fowler.) Price 6d.

This is a collection of over 300 short extracts from the writings of celebrated men which may be read with profit to the mind, and it may be with profit of a pecuniary kind also, for the editor (who also edits the "Naturalist's World") offers a prize of three guineas to the person who will assign correct authorship to the largest number of quotations.

THE NATURALIST'S WORLD continues to supply a monthly instalment of interesting facts relating to all departments of Natural History.

THE AUTOBIOGRAPHY OF A SALMON. By George Rooper. New edition, cr. 8vo, pp. 80. (London: J. S. Virtue & Co. 1886.) Price 1s.

In this interesting little book the salmon (*Salmo salar*) is supposed to relate its own autobiography, in the telling of which he occasionally makes certain very sage remarks on scientific angling and also on fish culture.

NEW SOUTH WALES AND HOW TO GET THERE: An Emigrant's Guide to Australia *via* the Cape of Good Hope, under the auspices of the New S. Wales Government. By Fred E. Johnson. 8vo, pp. 86. (London: Jas. Clarke & Co. 1886.) Price 1s.

This will be found an exceedingly useful little book for the would-be emigrant. The author, who has accompanied considerably over 2,000 souls to the land of promise held out by the Agent-General, tells all that is necessary about the voyage, the varying climates to be encountered, the necessary outfit of clothing, and the discipline which health and morality demand for a crowd of passengers upon the limited ground of a ship. There is a map of the route.

GRAPHIC MICROSCOPY: Illustrations drawn from Nature, and described by E. T. Draper, F.R.M.S. Lithographed in colour by Vincent Brooks. (London: Day & Son, 11, Palace Rd., Middle Lane, Crouch End, N.,

It will be remembered that one coloured plate, entitled "Graphic Microscopy," accompanied the monthly parts of *Science Gossip* last year. Mr. Draper is now publishing them himself. Each monthly issue will contain two coloured plates drawn from nature, and descriptive letterpress. The plates accompanying Part I. are Eyes of *Lycosa piratica* and *Anguinaria spatulata.*

La Science Pratique is the name of a monthly magazine published in Fribourg (Switzerland), Paris, and Brussels, under the editorship and direction of M. Adolphe Eggis. It contains a large amount of valuable information, arranged as follows:—I. Formulaire Technique; II. Economie domestique; III. Carnet du docteur; IV. La maison rustique; V. Procedes divers; VI. Connaissances utiles; VII. Questions et Réponses. At the request of M. Eggis, the editor of the *Scientific Enquirer* has arranged to receive orders for *La Science Pratique.* Price, 6s. per annum, post free.

Answers to Correspondents.

J. B. B.—Queries and Answers for the *Scientific Enquirer* may be sent in a halfpenny wrapper. They should be addressed to the Editor, and marked in top left-hand corner, "MSS. ONLY."

F. W. Clarke.—Thanks for your kind remarks. Please show the *Enquirer* to your friends.——W. S. A.—The numbers have been sent as requested.

F. A. A. S.—The question of publishing a list of Assisting Naturalists had scarcely occurred to us. If thought desirable by the majority of our subscribers, we shall be pleased to adopt it.

Communications received from:—B., W. Short, T. G. S., G. H. Bryan, V. A. L., B.Sc. (Plymouth), J. B. B., H. W. Lett, A. W. Griffin, R. A. R. Bennett, etc.

Sale and Exchange Column.

The Scientific Enquirer.

JULY, 1886.

*The Study of a few Common Plants.**

By George L. Goodale.

I.—Seedlings and Seeds.

1.—A STUDY OF THE PARTS OF ONE SEEDLING, AND THEIR RELATION TO THE PARTS OF A SEED.

A COUPLE of quarts of clean sea-sand in small flower-pots, or in shallow glasses, or in deep plates, will answer for the garden. The best seeds to begin with are beans and peas. The variety known as Horticultural Bean is large, and adapted to the purpose; but common White Beans will do about as well. Any of the ordinary varieties of Garden Peas may be employed. Two ounces of beans and one ounce of peas will be an abundant supply.

Let the student plant a dozen seeds of each sort half an inch deep in the moist sand, and place the flower-pots containing them on a table where the temperature will be about 65° or 70° Fahrenheit. It is a good plan to have the flower-pots covered at first by a pane of glass, in order to keep the sand moist. The student in charge of these cultures should take good care lest the sand becomes dry. When the seedlings start, which will usually be in two or three days, a second lot of seeds should be planted, and in two days more a third. At the end of a week or ten days, the seedlings will all be growing well. When the largest seedlings are four or five inches high, the suite of specimens will range from seeds just starting up to those with three or more green leaves. To complete the set, let a dozen seeds of both kinds be soaked in

* The series of papers, of which we give the first in the present number, is extracted, with slight alterations, from "Guides for Science Teaching," published for the Boston Society of Natural History by Ginn, Heath, and Co., Boston, U.S.A. The whole series consists of ten or twelve small pamphlets, most of which are illustrated, and will be found most useful to leaders of science classes.

water a day before the first systematic study of the plants. The bean-plants are to be carefully removed from the sand, and arranged by the students, who will place them in a series running from the largest down to the smallest, the latter being, of course, the soaked seeds which have not germinated.

With the series before him, the student may be left to himself to study out the differences and the points of likeness. He will carefully consider the differences between the largest, the middle-sized, and the smallest plants, in order to bring out the changes which have taken place by growth, match the parts which correspond to each other, and will at once identify the parts of the seedlings with their rudiments in the seed. He will trace back the roots of the plants to the tip of the cone-like body in the seed ; the shrivelled and greenish seed-leaves are seen to be the withering halves which made up the bulk of the seed ; the stem below these and the stem above, with its green leaves, are identified with their promise in the seed itself. He will see for himself how the seedling escaped from its integuments, and in what order its parts have successively appeared.

It is a good plan to have a few other seedlings of the same sort raised in a slightly different way ; namely, upon wet paper. These seedlings are wholly free from sand, and may serve to make the series a little more complete. For paper planting, use thick blotting-paper on a pane of glass. The paper is to be thoroughly moistened with warm water, and upon it a few seeds of each kind are to be placed. These are to be covered by a moist sheet of paper like the lower one, and the whole kept warm and damp. A damp sponge, or wet cotton-batting, or moist sawdust, would be just as good a support for the seeds ; the seeds need warmth, moisture, and access of air, and these conditions are furnished by any of the materials mentioned ; but the sand and the paper will be found in practice to be most convenient and cleanly. Another method of raising the seedlings may be mentioned at this point. After the seed has sprouted on wet paper, suspend it carefully by a thread, or upon a perforated card, over water in a tumbler or glass vase, so that the roots dip beneath the surface, while the seed-leaves remain held above. The roots will spread through the water, and the leaves will expand in the air. An acorn or a grain of Indian corn treated in this manner will be watched with great interest.

When the student has made himself familiar with the development of the seedling beans, and has compared their parts with the corresponding parts of the seeds, he is prepared to examine in the same way the seedlings of the pea. The sequence of points observed may be the same as before, but he should never let any order degenerate into a monotonous routine.

2.—COMPARISON OF TWO SEEDLINGS.

After this examination has been made, the comparison of the plants of bean and pea is to be undertaken. In some particulars the plants resemble each other closely, in other characters they are very different. The differences and the points of likeness are all to be brought out clearly, so that the following questions can be answered from the student's examination of the plants :—

1st.—What are the differences between the parts of the larger and the smaller plants of the same kind ?

2nd.—What are the differences between the two kinds of plants, the seedling bean and the seedling pea ?

3rd.—What do the seedling bean and the seedling pea have in common ?

Each of these questions must of course be much divided, in order to discover whether the whole subject has been thoroughly examined and understood.

It will be asked by some teachers whether it would not be well to furnish technical terms to the students at the beginning of their study. The late Professor Henslow believed that the ordinary botanical adjectives and nouns should be employed at the outset. His views upon this subject are very clearly stated in the following extract from his educational work * :—

" In order to secure a beneficial result of this sort [that is, to strengthen the observant faculties and expand the reasoning powers of young people], we must not avoid the use of certain technical expressions, however pedantically unnecessary they may appear to persons unacquainted with their importance and unaccustomed to their use. Scientifically accurate ideas must always be conveyed either by entirely new words or by peculiar technical meanings assigned to old words. Botanists employ both methods. Some of the most important technical terms have not been judiciously selected. Some are too long, others harsh and ungrammatical. But the few terms to which these objections apply cannot be satisfactorily dispensed with. They are thoroughly established, and are, in fact, much more readily learned than might be imagined."

Professor Henslow's first step in the instruction of his class was to place before them the following words to be correctly spelled from memory :—

* "Practical Lessons in Botany," by Prof. Henslow.

Class. (*I. Exercise.*)	Division. (*II. Exercise.*)	Section. (*IV. Exercise.*)
1. Dicotyledons.	1. Angiospermous.	1. Thalamifloral. 2. Calycifloral. 3. Corollifloral. 4. Incomplete.
	2. Gymnospermous.	
	(*III. Exercise.*)	
2. Monocotyledons.	1. Petaloid.	Superior. Inferior.
	2. Glumaceous.	
3. Acotyledons.		

One part of each Monday lesson consisted of a Hard-word Exercise. "Two or three words named one Monday are to be correctly spelled the next Monday."

This must be called an extreme method, and, at first sight, it would be called an impracticable one ; but, judged by its results, it is admirably adapted to some classes of students. (In a most useful adaptation and amplification of Professor Henslow's system of botanical teaching, Miss Youmans* has pursued a very judicious course. The technical terms are not thrust upon the student : they are introduced only as they are needed in recording the results of observation.) In oral instruction, however, it would seem to be better to let the technical terms come only when they can be of assistance to the student, and felt to be aids in his work. Technical words are short cuts across tiresome circumlocutions. Young people can be early made to feel that much is gained by their appropriate and timely use ; but in the simple studies of plants here recommended the employment of technical substantives and adjectives can be for the most part avoided. In the case of the youngest pupils, this avoidance of such terms should be regarded as very necessary : the term must never come between them and the thing or the phenomenon studied.

3.—Very different seedlings compared with each other.

To procure material for this purpose, plant in the manner before directed a few seeds of Pumpkin, Major Convolvulus, and Water-cress, and a few of the seed-like fruits (commonly called "seeds") of Sunflower, Indian Corn, Four-o'clock, and Wheat. The cress-seed need not be placed below the surface of the sand. When any of the seedlings have fairly started, let a second set of the seeds of the same be sown, and, when the latter have sprouted, plant a third set. Each kind of seedling is to be examined after

* "The First Book of Botany." By Eliza A. Youmans, New York.

the manner fully detailed with respect to the bean, and all its parts are to be matched with the parts seen in the seed. Afterwards let these different kinds of seedlings be carefully compared with each other, and with such seedlings of the bean and pea as may have been left over. The differences in development are plainly seen ; the points of likeness are not so obvious, but their recognition must be insisted upon. The student must be led by questions, never by statements, to see the resemblance between the seedlings before him. If this is honestly and patiently tried, it will be found that he, by a decided mental effort, will detect what the seedlings have in common. He will see that in some cases the seed-leaves have become pretty good green leaves, that in others they are shrunken and greenish, that in others they do not come into the light. He will notice also differences in number as well as shape. By adroit questions the teacher can lead the pupil up to the examination of what the seed-leaves can possibly be for, and, without furnishing any aid to the investigator, elicit at last the suggestion that they may be food-leaves for the young plant. Some young plants begin to earn their own living very early, others have a good store laid up for them, and this store of food is put in different places, and is of different kinds. Let the food be searched for in the Indian Corn and Major Convolvulus ; and, when the pupil has made out this for himself, the other kinds of food which seedlings have may be described as the teacher may have leisure. The food of the Vegetable-ivory seedling, which is as hard as ivory itself ; the food of the Nutmeg-seedling, the aromatic substance which makes up the bulk of the seed ; and other sorts of food, can furnish material for a talk which would not be uninteresting even to the dullest pupil. The oily food of flax-seedlings can be shown in some crushed flax-seed placed between dry blotting-paper. The linseed oil will appear in the paper. The very different food of wheat-seedlings may be exhibited best in very fine flour. The flour is to be slightly moistened in the hand and kneaded until it becomes an homogeneous mass. Upon this mass pour some pure water, and wash out all the white powder until nothing is left except a viscid lump of gluten. This is the part of the crushed wheat-grains which very closely resembles in its composition the flesh of animals. The white powder washed away is nearly pure wheat-starch. Of course the other ingredients, such as the mineral matter and the like, might be referred to ; but the starch, at least, should be shown. When the seed is placed in proper soil, or upon a support where it can receive moisture, and can get at the air, and still be warm enough, a part of the starch changes into a sort of gum like that on postage-stamps, and finally becomes a kind of sugar. Upon this syrup the young seedling feeds until

it has some good green leaves for work ; and, as we have seen in the case of some plants, it has these very early.

The starchy food in seeds keeps good a long while, and seeds having such food will grow, even after they have been kept for many years ; but the oily seeds are apt to spoil much sooner. The food in the seed is packed away in minute compartments (cells), and is used by the seedling in making new compartments for different kinds of work. How the starch was made for and put into the seed, and how it is used in growth, will be seen later on.

Short Papers and Notes.

"Comatula Rosacea" and "Lima Tenera" in Lamlash Bay.

ONE fine summer day a party of naturalists had a dredging expedition off the coast of the Isle of Arran. The ground chosen was Lamlash Bay, the sea bottom between that and "Holy Island" being a good field for many of the rarer marine animals. We were fortunate in securing many specimens, and at one haul of the dredge the two subjects of this paper made their appearance. At first we imagined we had only made a haul of coral of a reddish tint—viz., *Millepora Polymorpha*, but on examination it was found to be full of living beauties. *Comatula Rosacea* (or the Feather Star) was entwined among the roots of the *Laminaria* weed, but on untwisting it, and throwing it into a tumbler of sea-water, it spread itself out in all its beauty. From the little disc in the centre proceeded from twenty-five to thirty scarlet limbs, exactly like minute ostrich plumes, the only difference being that every one of them was instinct with life, beauty, and graceful motion. The greatest interest attached to this star-fish is that, while in its immature condition, it is mounted on a stem, being then the representative of a tribe of sea animals now very rare, Encrinites (or stone lilies), the stems of which are found in great abundance in most limestone quarries, the detached joints being known as "St. Cuthbert's Beads." So, beginning life as an encrinite, the feather-star changes its nature so far, in a year's time, as to become a Star-fish, and a more beautiful one cannot be imagined, as dropping from its stem (as if out of swaddling bands), it swims

about a true *Comatula*. Their swimming is even more rapid than that of the *Medusæ*.

A more lovely denizen of the ocean it is difficult to conceive than the *Lima Tenera* and its coral nest. It is a small oval-shaped bivalve, its shell resembling porcelain in appearance. This shell, however, not being large enough to contain the whole of its fair inhabitant, a fragile, orange-coloured fringe that hangs in graceful threads all round being entirely left out, which of course would be continually exposed to the attacks of remorseless and hungry enemies. So, not contented with hiding amongst the loose coral, it builds a mansion for itself out of that elegant material, by collecting numerous pieces together. Then, by some mysterious power, it spins a slender cord, intertwining it, out and in, among the several pieces, thus binding them firmly together. This nest is rough and jagged enough outside, but within everything is smooth and delicate, befitting the residence of such a tender creature, for it weaves the same lubicrous cordage into a lining, filling up the interstices with smooth slime as soft as silk. Just lift the *Lima* out of its nest, and put it into a jar of sea-water, and it will charm you with its beauty. It swims about as vigorously and spasmodically as the *Pectens*, the fringe at the same time waving about in graceful filaments, intent on catching its prey. MINNIE MCKEAN.

A Bear's Fishing Ground for Salmon.

The salmon, the cousin of the trout, is famous for its method of going up stream ; it darts at falls ten or twelve feet high, leaps into the air, and rushes up the falling water in a marvellous manner. So determined are the salmon to attain the high and safe waters that in some localities nets are placed beneath the falls, into which the fish tumble in their repeated attempts to clear the hill of water. Other than human hunters, moreover, profit by these scrambles uphill. Travellers report that on the banks of the Upper St. John River, in Canada, there was once a rock in which a large circular well, or pot-hole, had been worn by the action of the water. At the salmon season this rock proved a favourite resort for bears, and for a good reason. Having an especial taste for salmon, the bears would watch at the pot-hole, and as the salmon, dashing up the fall, were thrown by its force into the rocky basin, the bears would quickly scrape them out of the pot-hole, and the poor salmon would be eaten before they had time to wonder at this unlooked-for reception. The Dominion Government finally authorised a party of hunters to destroy the pot-hole, and thus break up the bears' fishing ground. —*Christmas St. Nicholas.*

The Caulking of a Pre-Historic Ship.

A very interesting discovery was made at Brigg, North Lincolnshire, a few weeks ago. In excavating a tank for a gas-holder an ancient boat was found buried in the alluvial clay of the Ancholme valley. This boat was made out of a huge oak log, the size of which may be imagined when it is found that the boat is 48½ feet in length, and 4½ feet wide at the stern, which corresponded with the butt of the tree. The inside of the boat is dug out of the solid wood, and a flat stern-board has been fitted into a groove made for the purpose of receiving it. The only mode used for fastening the stern-board was a lashing, which passed through holes in the gunwale, just abaft the board. The joint was made water-tight by being caulked with moss. The same substance was used for caulking the seams where some patches had been put on the side of the ship. Considering the geological position of the alluvium in which the boat was found, it is probable that it was made and abandoned at some time previous to the Roman occupation.

ALFRED ATKINSON, C.E.

The moss which formed the caulking in the pre-historic ship recently brought to light at Brigg consists of portions of two species.

That which is most abundant in the specimen is *Thuidium tamariscinum*. It has a dull appearance, arising from the leaves being covered all over with minute papillæ, or soft superficial glands, and the stem is densely clotted with paraphyllæ, or downy rootlets; both these features are quite distinct and well preserved in the portions examined, which, instead of being green, are brownish. This is one of the most common and beautiful of our *Hypnums*, or Cushion Mosses, and a bank covered with its green branches, which grow out in the manner of a miniature fern, is a lovely sight. It is still much used by the makers of artificial flowers for some purposes of their trade.

The other is *Hypnum triquetrum*, a stout, erect plant, of a bright shining green, that is permanent even when dry. The specimen retains its shining appearance, but the green has been changed to olive by the conditions under which it lay buried in the old craft. This is the moss commonly used for making moss baskets, for which purpose it is sold in the London markets.

The habitats of these mosses are banks in woods, where they may often be found growing together, as doubtless they did when the inhabitants of Lincolnshire plucked their handfuls in days of old to serve the purposes for which oakum is now used.

H. W. LETT, M.A.

The Freezing-Point.

It may be interesting to know how, for scientific purposes, the freezing-point is fixed, and what important phenomena there are in connection with the transition of water from the liquid to the solid condition. The freezing-point is that at which the mercurial index stands when the bulb of the thermometer with part of its stem is embedded in a mixture of snow and pounded ice, the atmospheric pressure being 76 centimetres. This is how it is actually determined, but it may be simply taken as that temperature at which water turns into ice or ice into water. Although we are so familiar with mercury-in-glass thermometers, it may be mentioned that the standard thermometer at Kew Observatory, with which standard thermometers are from time to time compared, is not a mercury thermometer at all, but one depending on the contraction and expansion of air. Regnault was the first to point out the advantages of such a standard. The main objection to the ordinary mercury thermometer as a standard is that different kinds of glass expand very differently. In regard to water, the fact that its maximum-density point—that is, its point of greatest contraction—is not its freezing-point, but 4·1 degrees above it, presents us with one of the most remarkable phenomena in the economy of nature. From the effect of the winter, cold lakes and other bodies of water gradually cool down. The surface layer becoming specifically heavier than that below sinks to the bottom, while that which has come up in its place becomes more dense even than that which displaced it at the bottom ; and the result is that a constant exchange of layers of different temperatures goes on till the whole reaches the uniform temperature of 4·1 degrees Centigrade, which, as has been said, is the maximum-density point. Now, supposing the cooling goes on to the freezing-point, the surface layer no longer goes to the bottom, but, through the expansion which takes place in its transition from the temperature of 4·1 degrees to the freezing-point, remains on the top, and at length freezes. The warmer or more dense water underneath continues at 4·1 degrees, and thus saves the fish from perishing through that congelation of the whole mass which would ensue were the freezing-point of water coincident with its point of maximum density. It is found, too, that the ice on the surface protects the water below even in the coldest winters.—*Glasgow News*.

A Pretty Ornament.

Dissolve one ounce of acetate of lead (sugar of lead) in one and a quarter pints of distilled water, add a few drops of acetic

acid ; place the liquid in a clear glass bottle, and suspend a piece of zinc in it by means of a fine thread suspended from the cork.—*Scientific American.*

A Japanese inventor claims to have made from sea-weed a paper transparent enough to be substituted for window-glass.

An Insoluble Cement.

Take of gum shellac, 3 parts; india-rubber, 1 part, by weight. Dissolve the rubber and shellac in separate vessels in ether, free from alcohol, applying a gentle heat. When thoroughly dissolved mix the two solutions, and keep in a bottle highly stoppered. This glue resists the action of water, both hot and cold, and most of the acids and alkalies.

The addition of not over 2 per cent. of potassium bichromate to a solution of glue, and subsequent exposure of the glued parts to the sunlight, will make an insoluble cement.—

Scientific American.

A Pre-Historic American Home.

Major Powell, chief of the United States Geological Survey, has discovered in New Mexico, near California Mountain, what he pronounces to be the oldest human habitation upon the American continent. "The mountains in this vicinity," says the Sante Fe *New Mexican*, "are covered with huge beds of lava, in which the pre-historic man and his comrades have excavated square rooms, which were lined with a species of plaster made from the lava, and in these rooms were found various evidences of an advanced civilisation, among them being a species of cloth made of woven hair, and a large number of pieces of pottery. In the sides of the rooms cupboards and shelves were excavated. In a little concealed niche there was discovered a small figure resembling a man, done up in a closely-woven fabric, which with the touch of the hand turned to dust. It was blackened and crisp like the mummy cloths of Egypt. In all, some sixty groups of these lava villages were found, there being about twenty houses in each group. The evidences of civilisation were similar to, but removed by their condition and want of skill a considerable distance from, the articles which have been found in the cliff-houses, which have been very fully described in the reports of the Geological Survey."

H. W. LETT.

A New Use of Indian Ink.

M. Leo Errera calls attention in the *Bull. Scient. du Depart. du Nord* to the value of Indian ink, on account of its harmlessness and intense colouration, for the study of certain microscopic organisms. He has succeeded in keeping infusoria, etc., alive for several days in the liquid, the carbonic matter not appearing to affect them in the slightest degree. For making durable preparations ink diluted with water should be gradually replaced by that diluted with glycerine. Many organisms which are distinguished with difficulty in water are easily observed in water charged with Indian ink. This is especially the case with many algæ. M. Errera thinks that this new method could probably be applied with advantage to the study of the digestion of the infusoria, and to the movements of ciliated organisms.—*Mon. Mag. Phar.*

Ocean Mountains.

A French geologist, Mons. de Lapperent, lately called the attention of the Paris Geological Society to the effect gravitation has in heaping up sea waters upon the land. The continents are thus all situated at the tops of hills of water ; and in crossing the Atlantic the ship has first to go down-hill, then to cross a valley, and finally to climb another hill. The calculation has been made that in mid-ocean the surface may be more than half-a-mile (1,000 metres) below the level it would have if the continents exerted no attraction.

California.

The fruit production of California is, says a Boston paper, something enormous. During the year 1885 she produced :—

Raisins,	over	9,000,000	pounds.
Prunes,	,,	1,500,000	,,
Apples,	,,	1,823,000	,,
Peaches,	,,	1,900,000	,,
Plums,	,,	1,139,000	,,
Apricots,	,,	650,000	,,
Honey,	,,	2,250,000	,,
Walnuts,	,,	1,250,000	,,
Almonds	,,	1,050,000	,,
		20,562,000	,,

A Luminous Tree.

It is stated that a tree is growing near Tuscararo, Nevada, which at certain seasons is so luminous that it can be distinguished a mile away in the darkest night. It is also said to give sufficient light to enable a person to read the finest print. The luminosity is said to be due to parasites.

Cement for Micro Work.

This cement I have found unfailing in micro work under a "finishing varnish":—

Goldsize	... ...	2 oz.
White lead	... ...	$\frac{1}{2}$ oz.
Red lead	... ...	$\frac{1}{4}$ oz.
Patent Dryers	...	1 dram.

Grind the white lead, red lead, and dryers very fine; then add the goldsize, which must be the very best and old. E. W. W.

Answers to Queries.

6.—**Foreign Lepidoptera.**—For relaxing these I far prefer plaster of Paris to sand. The plaster should be stirred up with water to form a paste, poured into the bottom of a shallow biscuit tin with a tight-fitting lid, and allowed to harden. To moisten the plaster, pour some water over it, and after a short time drain it off. A piece of perforated zinc may be laid on the plaster to prevent the insects from touching it. The butterflies are laid on this, and the box closed and put in a warm place. I relaxed 150 butterflies from Ceylon in this way. One of the large *Ornithoptera Darsius* was ready for setting in twelve hours, while others of this species required four days. Some Mentone butterflies caught seven years previously, were ready to set after five days. When set, the insects must be left on the setting board for *at least* a fortnight (three weeks is better), otherwise the wings will spring out of place. If this precaution is attended to, the insects will rarely spring at all, but should any show a tendency to do so, the wings may be fixed in place with a very little thick gum (containing a drop or two of glycerine) placed at the base of the wings on the under side. G. H. BRYAN.

22.—**Glastonbury Thorn.**—See *Science Gossip*, volume for 1885, p. 11. B.

28.—Varnish for Background.—I have used Matt Black (made by Ward of Manchester) for a *dead* black background for microscopic objects, for some years, and have found it most useful, as it dries quickly and is not readily scratched off the glass. This may answer equally well, I think, for photographic purposes (query 44). W. SHORT.

28.—Varnish for Background.—I have tried all kinds of varnish for dark backgrounds, but cannot find any that answers the purpose. I now use a disc of black unglazed paper, placed on a disc of asphaltum. This when quite dry gives a fine, smooth, and dull surface. T. G. S.

30.—Cutting Sections of Coal.—The best way is first to grind a surface flat, and then with lapidary's cement to fix that surface to a block of wood, by means of which the fossil can be again ground down until considered thin enough. But then it is difficult to detach the fossil from the block and to remove the cement without breaking it. I, therefore, cement the flattened surface to a piece of plate-glass with Canada balsam, and then grind it down with emery on a plate of copper. The glass and cement (Canada balsam) both being transparent, the operator could determine when he had arrived at the proper degree of thinness, and when that is attained it is only necessary to polish the surface. Some coal is so friable that no sections can be made from it by the above method. In such cases it may be ground to fine powder, and the particles, after being mounted in Canada balsam, may be subjected to microscopical examination. It cannot be supposed that the result will be very satisfactory, but it is of considerable comparative value in relation to other and more compact varieties. Even the ash of coal (obtained by burning to white ash a specimen of coal previously boiled in nitric acid), if carefully mounted in Canada balsam, often exhibits mineral casts of vegetable cells and fibres. The ash of the Welsh anthracite is useful for this purpose. There is another method described in the "Micrographic Dictionary" and *Science Gossip*, but I have not tried it, and from the accounts in the latter paper (some years back) I do not think it practicable. V. A. LATHAM.

46.—Mounting Botanical Specimens in Glycerine Jelly.—Place the object on the slip, put on thin cover, and hold it with a small clip. Warm the slide over the lamp, and then drop some of the glycerine jelly at the edge of the cover-glass, and it will run under by capillary attraction. Now hold it over the lamp until the jelly boils; sometimes there will be a little spluttering, but the degree of boiling point is usually signalled by a slight explosion. Have ready a cold slab, on which to place the slide, and in the course of a few minutes the superfluous jelly may be scraped

away and washed with a bit of sponge, carefully removing every particle of jelly. Ring the edge with old gold size, or Bell's cement. Some deviation from the above may be necessary for certain objects. In mounting mosses, particularly the *Sphagna*, I find the slides sometimes require boiling (over lamp) nearly a minute before the air bubbles in the interstices of the leaf cells become dislodged. V. A. L.

55.—Mounting without Pressure.—I was sorry to find that no one answered this query in the June number. I have for a long time tried to mount insects without pressure, and have to a certain extent succeeded. My *modus operandi* is as follows :—

1.—Immerse specimen (say leg of *Dytiscus marginalis*, leg of bee, or a whole insect) in liquor potassæ, until the colour is sufficiently reduced ; this will take from three to four weeks, more or less, according to the size, etc., of the specimen.

2.—Lift the specimen carefully out of the potash into pure water, changing the water at frequent intervals to eliminate all traces of the chemical, always taking care that the specimen is not pressed or squeezed in any way ; or, what is better, procure a wide-mouthed bottle, holding about $\frac{1}{4}$-pint, and, having fitted it with a bung, cut with a small file about four or five not very deep grooves in its circumference, and pierce a hole through its centre ; then push through the hole the stem of a small glass funnel ; put specimen, fresh from potassæ, into bottle (which should have been previously filled with water), adjust the bung, and allow a gentle stream of water to fall from a tap into the funnel and thus into the bottle, the superfluous water with the potassæ escaping through the notches at the side of the cork. The washing should occupy some two or three hours, and any number of specimens can be done at one washing.

3.—Lift the specimens out of water into another vessel containing pure distilled water, and transfer them from this into methylated spirit, being careful to keep them well covered. Change the spirit about three times in the course of the same number of hours, and then put them into absolute alcohol for a short time.

4.—Transfer the specimen to oil of cloves to take out spirit and to clarify it.

5.—Having previously prepared a cell of sufficient depth for the object (a tin or glass cell, fastened down with marine glue), see that all is perfectly clean ; then fill the cell with pure benzole, to take air out of interstices, etc. (if any), and as this is poured out of the cell, with a glass tube take up a quantity of benzole-balsam, and drop a small quantity into the cell. Place the object into the balsam, and carefully arrange it in the centre ; then drop on more

balsam, and carefully arrange it in the centre; then drop on more balsam until it appears to stand slightly above the cell. Place the slide in a dry place, and cover with a wine-glass to protect from dust. Examine in a week, and if from the evaporation of benzole the balsam has sufficiently hardened and shrunk, put a drop or two more benzole-balsam on, and allow time for the evaporation, when the cover must be carefully laid on, and if there is a sufficiency of the medium in the cell this can be done easily, without including air bubbles. After standing some time to dry, the balsam at the edges of the cover should be carefully cleaned, a ring or two of brown cement run round the edge, and when that is perfectly dry finish with white zinc or other varnish.

The above is only one way, and I still hope to hear, through the medium of the *Scientific Enquirer*, the way Enock and others mount *without pressure.* It is just possible that Mr. Enock's medium is glycerine and not balsam. I intend to find out if I can. AMATEUR.

59.—Oil Immersion Lenses.—If "Bacterium" wants a cheap immersion lens (not oil), I can recommend Seibert's as being very fair glasses. I have a sixteenth, with collar adjustment, which I bought of Charles Baker, London; angle, 175°, I think. It works well, and the cost was under £4. J. H.

65.—Worm-eaten Wood.—There are several fluids which will destroy the insects, carbolic acid or methylated spirits of wine generally being used. After one of these has been allowed to soak into the wood, the holes should be filled up with thin plaster of Paris, whiting and oil, or patent knotting, if it is to be painted or stained. R. A. R. BENNETT.

66.—Schizonema Grevillei.—The best medium for mounting diatoms of this filamentous type is, I think, undoubtedly Hantzsch's preservative fluid. It is composed of the following:—Alcohol (absolute), 3 parts; distilled water, 2 parts; and glycerine, 1 part. For complete instructions I would refer Mr. FitzGerald to p. 57 of Nave's work on the Collecting of Algæ and Diatoms.

ALFRED W. GRIFFIN.

67.—Diatoms.—The various ways of mounting Diatoms, as well as preparing them, are given at length in Davies' little book, "The Preparation and Mounting of Microscopic Objects," published by Bogue. It would require a whole number of the *Scientific Enquirer* to answer Mr. FitzGerald's question so as to be of any use to beginners with the microscope.

H. W. LETT, M.A.

67.—Diatoms.—The method of mounting depends upon the purpose which they are intended to serve. If they are quite fresh, and it be desired to exhibit their natural appearance, put up in aqueous media (carbolic acid, salicylic acid, dilute spirit, etc.), in cement cells. If not thus mounted within a short time after they have been gathered, add about one-tenth part of alcohol to the water. To exhibit the stipitate forms in their natural parasitism upon other aquatic plants, the entire mass may be mounted in Deane's Medium or glycerine jelly, and such form very beautiful objects for spot-lens illumination. Diatoms having siliceous envelopes are cleaned by boiling them in nitric or hydrochloric acid, they must then be well washed and boiled in water with a small piece of soap, which cleans them from any flucculent matter; finally wash in distilled water and mount either dry or in Canada balsam. V. A. L.

68.– Microtome.—To make botanical sections a microtome is seldom used. It takes a little practice to cut with the hand, but in less than a week "Micro" will give up all thoughts of buying a microtome, unless it be that he is investigating subjects of such a soft nature that they require to be frozen. In that case I have found those made on the joiner's plane principle make the finest cuts. Crouch sells a very good one, called Williams' Freezing Microtome, at £2 10s. By the way, in cutting sections of leaves, stalks, and such like by hand, an inch or two of pith should be cut down the centre, the stalk inserted, and the whole held firmly between the fore-finger and thumb of the left hand, while the razor is held in the right. B.Sc., *Plymouth.*

68.—Microtome.—There is a description, with a figure, of an inexpensive microtome, by Surgeon G. M. Giles, in *Science Gossip* for 1885, Vol. XXI., pp. 7—9. The article is so concise that to quote would be useless. Full directions for making and using the instrument are given, which, as the author says, "can be made by anyone with a slight mechanical turn for eighteen-pence." I made one for myself, and find it most satisfactory for botanical sections at 500th of an inch, and my actual outlay for the materials was only one shilling. H. W. LETT, M.A.

68.—Microtome.—A small hand microtome (Ranvier), suitable for cutting stems, etc., in plain brass (or it may be clamped to the table), can be bought for from 4s. to 6s. For ether freezing I can strongly recommend Cathcart's 17s. 6d. (complete). If desired, an extra instrument used for imbedding can be had, made for the same instrument by Mr. A. Frazer, Lothian Road, Edinburgh, for a moderate sum, and from whom all particulars can be obtained. V. A. L.

76.—Photography.—Jno. E. Fawcett is quite right in supposing that "a simple accident to the lens itself is out of focus of the lens, and consequently does not do much harm to the picture." Besides, as the cracked lens is only one of four, the effect is minimised. B.Sc., *Plymouth.*

80.—Renal Tube Casts.—I do not know of any method of preserving these, although an experiment might be made with a one per cent. carbolic acid solution. The staining is simple. After covering a drop of the liquid containing the casts with the usual cover-glass, take a drop of the stain preferred on a glass rod, and hold it at the edge of the cover-glass; capillary attraction will cause it to run in. B.Sc., *Plymouth.*

81.—Canada Balsam.—Chloroform is a far better solvent than benzole, and in my experience does not darken the colour in the least. B.Sc., *Plymouth.*

84.—Bleaching Insects.—"Micro" will find that a weak solution of chloride of lime answers well. I recently bleached the leg of a cockchafer in that way, with very good results.

J. Benjamin Bessell.

84.—Bleaching Insects.—Soak the parts in liquor potassæ for 36 hours, wash well, and soak in dilute spirit for 24 hours, then in methylated spirit; take it out, drain all moisture off, and place it in oil of turpentine, transfer to benzole, and it is then ready for mounting. I believe the following renders parts of insects transparent:—10 drops hydrochloric acid; ½ drachm chlorate of potash; 1 ounce water.

H. Purefoy FitzGerald.

84.—Bleaching Insects.—Liquor potassæ is one of the best mediums for this purpose. B.Sc., *Plymouth.*

87.—Asphalte Varnish.—In answer to "Mac," my experience of asphalte varnish is chiefly as a second covering to the ring. It is much used in the German laboratories (where I worked for years) without any primary coating; but after some years it cracks and allows the glycerine to get out and air bubbles to get in. I find it an improvement to ring first with gold size or shellac dissolved in spirit. I have not had time to try the following cement brought forward by Heydenreich, but from what I have read of it, it appears to answer all the requirements of a good cover-glass cement. Take equal parts best, clearest, and hardest amber varnish and copal varnish; mix and heat until all the turpentine has disappeared—this requires a temperature of from 100° to 150° R. Allow to cool somewhat, and add oil of lavender in proportion of ½ to 1. Mix well, and allow the mass

to cool thoroughly ; add 20 to 40 per cent. of artificial cinnabar (eosin with cinnabar), which should be very carefully and thoroughly rubbed in, same as in oil paints. If too thick, add oil of lavender. B.Sc., *Plymouth.*

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

88.—Sting of Bee.—Could anyone tell me how to cut out and mount a bee's sting ? I have the bee preserved in methylated spirits. F. W. STEEL.

89.—Classification of Slides.—Under what *class* and *order* should the following marine animals be arranged :—*Junculla*, *Litogorgia*, *Meliloides*, *Plexaura*, and *Villogorgia ?*
J. BENJAMIN BESSELL, *Bristol.*

90.—Foul Brood in Bees *("Bacillus Alsei").*—1.—Have any readers tried thymol or boracic acid for the cure of this dreadful pest of bee-keepers ? Phenol will cure it, but the smell is so strong that there is great difficulty in getting the bees to eat the syrup in which the phenol is mixed. 2.—Is "*Bacillus Alsei*" animal or vegetable ? H. H. WILLIAMS.

91.—Cuticles of Leaves.—Can any reader give me an idea how to detach the cuticle of deutzia, or other plant, *entire ?* It is done, I believe. Some of the text-books say boil in water in a test-tube, and then strip off the cuticle ; this is where the difficulty lies. Is not something omitted in the advice, for I have tried this plan and utterly failed ? H. E. H.

92.—Humble Bees and Moss.—Can any one tell me why the very large humble bees (I do not know their particular name) dig up the moss in such quantities in moss walks or mossy banks ? Sometimes several feet at a stretch will be found quite spoilt by them. It might be for their nests, only they do not seem to carry any away ; it cannot be for their food. Is it only mischief or amusement ? M. A. HENTY.

93.—Ringing Slides.—I shall be glad if some adept at ringing can inform me whether Enock's slides (and others) are protected

from *running in* by a previous application of gold-size, or whether a cement or varnish is used that will *not* run in, and what that cement or varnish is. H. E. H.

94.—New Glass for Objectives.—Can you give me any information as to the nature and composition of the new glass that has been made by Dr. Carl Zeiss, of Jena, for microscopical objectives? BETA.

95.—Bot-fly.—Can anyone give me the history of the bot-fly *(Gasterophylus equi)?* I want to know how long the larva remains in the stomach of the horse. Is there any sign of it being present, and what is the cure?

H. PUREFOY FITZGERALD.

Correspondence.

The Editor does not hold himself responsible for the opinions or statements of Correspondents.

To the Editor of the "Scientific Enquirer."

DEAR SIR,—I trust you will be able to carry out the suggestion of "F. A. A. S.," and publish a list of "Assisting Naturalists." I for one should be most glad to avail myself of its advantages, and, in fact, wrote you a letter during last month enquiring if such a desirable adjunct existed in connection with the Postal Microscopical Society. The letter would have been posted now, but "F. A. A. S." has forestalled me. J. B. BESSELL.

[We shall be glad to receive the names of those of our friends who are willing to offer themselves as Assisting Naturalists. They should state in what department of Natural History they are best able to render assistance.—ED.]

Reviews.

ALBUM AND CATALOGUE of British and Foreign Postage Stamps, giving a full description of all stamps issued, and accurately describing the Arms, Coinage, Area, Population, Chief Town, and Reigning Government of every Country. Revised, corrected, and brought up to present date by Dr. Viner. Fscap. 4to. Album pp. 260, Catalogue pp. 132. (London: William Stevens. April, 1886.) Price 6s. and 7s. 6d.

There is nothing specially new in the design of this Album. The Cata-

logue professes to give an account of all issues up to date, but on carefully comparing it with a large collection of stamps in our possession, we find many of the earlier issues are omitted. There are no illustrations, and what stamp collectors speak of as "The Catalogue value" of stamps is not given.

YOUNG FOLKS' DIALOGUES. Designed for use in every form of Public and Private Entertainment. Edited by Chas. C. Shoemaker. Post 8vo, pp. 120. Price 25c.

THE ELOCUTIONIST'S ANNUAL. Vol. XIII. Edited by Chas. C. Shoemaker; pp. 200. Price 30c. (Philadelphia, Pa., U.S.A.: National School of Elocution and Oratory. 1885.)

These little books contain rich stores of amusing readings and recitations, which will prove acceptable to our young friends.

The Processes of Electrotyping and Stereotyping, by H. C. Whitcombe and Co., Boston, gives full instructions in the above art as employed in book illustrations. It is, however, thoroughly technical, and therefore will not prove of much use to the amateur.

GYRATING BODIES is the title of a very interesting paper read before the Scientific Section of the Vassar Bros. Institute, U.S.A., in February, 1885, by G. B. Warring, Ph.D. It treats of the Gyroscope, Tops, Bohnenbergher's Machine, Precession Gyrostatic Balance, Gyrostat Gyrocycle, The Earth, Nutation, Gyrostatic Compass, and Gyrostatic Pendulum. It is a paper of much interest, from which we hope to make a few extracts at a future time. It is illustrated by upwards of 50 figures.

Answers to Correspondents.

Will Mr. W. H. Grath, who wrote us May 13th, kindly write again, our reply by post having failed to reach him?

A. L. Woodward.—We think your paper a valuable one, and trust you will often favour us; we value and esteem highly our foreign correspondents. Please write frequently.

Capt. L.—Your communication unfortunately came too late for insertion in present issue. We are compelled to defer the publication of Papers, Queries, and Replies from the following until August:—Beta, E. K., John E. Fawcett, W. H. Lett, E. S. Carroux, A. L. W., C., Z., S. H., etc.

Sale and Exchange Column.

Worked Flints, Paleolithic and Neolithic, in exchange for Fossils.—Apply by letter, J. French, Felstead. I will pay all charges.

Microscopical Slide Labels for Animal and Vegetable Kingdom, toned paper, 6d. per 100; samples of 33 kinds, 2d.—Chas. Watkins.

Insects in Spirit and Dry, selected for Mounting. New List ready.—Chas. Watkins, King's Mill House, Painswick, Gloucestershire.

Fish Skins.—Send stamped addressed envelope for a specimen of the Skin of the Spotted Dog Fish, cleaned and ready for mounting dry, to H. E. Hurrell, 1, Church Plain, Great Yarmouth.

High-class Injections from Monkey, consisting of lip, tongue, liver, lung, spleen, finger. The six slides for 5s.—Henry Vial, Crediton, Devon.

The Scientific Enquirer.

AUGUST, 1886.

*The Study of a Few Common Plants.**

By George L. Goodale.

II.—How the Parts of Flowering Plants Help One Another.

THIS series of lessons is devoted to the consideration of only the flowering plants, those which have true blossoms and bear seeds with plantlets in them. Therefore, mosses and their kindred are not now treated of. If either of the seedlings spoken of in Part I., chapters 1, 2, or 3, page 101, etc. be carefully examined when it has a few green leaves, it will be seen to be made up of roots, stem, leaves, and a few delicate plant-hairs. Now, these are all the parts that any flowering plant ever has: the thorns and tendrils, and showy leaves and blossoms, and all the parts of every blossom, are only modified forms of one or more of the four parts or members just spoken of. This is the statement, made abruptly and in few words, of the accepted theory of plant structure. This idea may possibly appear difficult and abstruse; but, inasmuch as it is of great assistance, even in a very rudimentary study of common plants, the endeavour to understand it ought to be made. The attempt to explain this may be successfully made in the following manner: The student should have before him several series of older seedlings with plenty of leaves and good roots, and he must ask himself some such question as this: How many times are parts which are made up of *a joint of stem, and a green leaf above*, repeated in each plant? In one, there will be six or more of these repeated parts; in another, only two or three; in another, perhaps only one. That the "repeated parts" differ greatly in their shape has been

* From "Guides for Science Teaching."

noticed in the study of the seedlings; that the repeated leaves have different kinds of work was also then made plain. If this is clearly understood, he will have grasped the idea that these "repeated parts" are *helping parts* or *helpful parts.* These parts are mutually helpful: they help one another. The whole plant is made up of just such parts, which have taken different forms for different kinds of work, as, for instance, in the leaves of the pea. It has been found that students grasp this notion of the helping parts very readily, and hold it very firmly, as an aid to their further progress. (Although it is advisable in the case of more advanced students to bring out clearly the notion of the phyton, or phytomer, the internode of stem with its node and leaf, it is generally better for them to learm that the helping parts are joints of the stem with the leaf which belongs to it, and that any one of these helping parts may have roots and hairs, and further, that they take very different forms for different kinds of work.)

The seedlings have shown these helpful parts arranged in regular order. From the lowest of the helpful parts of the bean the root started; but in the Indian corn, roots have started off also higher up. Again, they have plant-hairs in different places. Upon the youngest rootlets of the wheat or Indian corn planted on wet paper, the hairs are very abundant; and there are some hairs scattered on the leaves of the bean. These roots and the hairs are to be examined later.

The succession of the helpful parts will be noticed best in slips of the common plants, "Wandering Jew," or Tradescantia, Heliotrope and Bouvardia. In the case of the Tradescantia, the growth of a slip or cutting in moist sand, or with the lower end in water, is very instructive: roots grow from the lowest of the helpful parts, and furnish the food needed in solution, new leaves expand above to get food, as will be seen, from the air; and thus a separate self-supporting colony is established. A flowering plant is a community from which many such colonies might be removed.

Next, the student should well study the question: Where do these helpful parts come from? For this purpose, a good branch of Horse-chestnut, stripped of its leaves, but having buds, will be found useful. He should, from the knowledge of the subject which he has already acquired, be able to study and thoroughly understand this without any help; in fact, if any aid is required, it may be accepted as an indication that he has made too great haste and to very little purpose. A youth who has patiently gone through the examination of the seedlings will be able to see that the bud-scales are leaves, changed in form, to be sure, but not so much as some of those in the seedlings, and that

these leaves are regularly but closely packed upon a tiny space from which the stem is to grow in the spring. In many of the larger and more plump buds of horse-chestnut, the rudimentary flower-cluster can be seen. He should next consider how old a fragment of a branch with a terminal bud is ; and, if he has fully grasped the idea that a bud is the promise of a branch, he will count back and see how many rings of bud-scale scars there are on the stem. The clusters of rings mark the years.

In the buds of Lilac, the four-sided character of the bud will probably attract attention. Any of the large buds of our deciduous shrubs and trees will present many interesting features for examination, namely, the relative size, *position normally in the upper angle which a leaf makes with the stem*, the protective scales or outer parts, the mode of packing, and the presence or absence of flowers within. It must not be supposed that the subject of buds can possess as much interest for younger as for the older students ; nor will it be found for the latter so interesting as the study of seedlings and flowers. But nevertheless good use can be made of the abundant material for study which our common buds afford. In winter, or, better, at the approach of spring, shoots with strong buds can be kept fresh for a long time by dipping the lower end of the cutting in water, and sometimes the buds will develop good leaves. Shoots of Rhodora and Cassandra having flower-buds will bloom after a few weeks' exposure to the warm air of a room, provided the cut ends are not allowed to dry. And this brings up the allied subject of flower-buds and what they teach. Let the student procure for the purpose of this study good flower-buds of any common house-plant ; and with these he should take large leaf-buds of Lilac or Horse-chestnut for examination and comparison, when he will at once notice the regular though different arrangement in the various parts of buds, and recall the fact that a bud is the promise of a branch. The application of this knowledge to the case in hand will force the conclusion that, since whatever springs from a bud is some sort of a branch, a developed flower from a flower-bud must be a branch too. And so it is. The helpful parts are here arranged in a very regular manner, and many of them are greatly changed in form and in work. From this subject, to be examined fully in another place, we pass naturally to the development of buds underground. A leaf-bud—that is, an incipient stem—develops by lengthening the distance between the successive leaves. Under ground, in firm soil, such buds develop to great disadvantage ; and the stems soon become more or less distorted, the degree of distortion depending somewhat upon the character of the soil in which growth takes place. The extremes are to be found in Beach Bind-grass (*Calamagrostis arenaria*), which has long internodes or

joints of stem, and such plants as *Iris*, or Blue Flag, and Solomon's Seal. In not a few cases, the growth of the underground stem gives rise to very curious forms, which may be puzzling at first ; for instance, the solid bulb or corm of crocus, and the thickened tip of the underground branch of potato, namely, the tuber itself. The "eyes" of the potato are merely disguised buds which have a good stock of food behind them. Potato-planting is colonising, in which the tubers are the colonies separated from the home community. A very bad kind of such colonising takes place when the underground stems of Witch-grass (*Triticum repens*) are only broken off, but not taken out of the soil, in hoeing the ground. The helpful parts are detached from each other, and each fragment serves as a starting-point for a new plant. In grafting and in budding, one or more groups of colonies of helpful parts are removed, not to soil where they would have at once to shift for themselves, but to a kindred plant, which furnishes proper nutriment from the very first.

Thus it will be seen that from a few kinds of buds the student may learn a good many things. He will clearly apprehend the notion that buds consist of helpful parts, which are packed away in a rudimentary form ; and will, in a short time recognise buds under their many disguises in bulbs, bulblets, and the like. When he has made this out he will next proceed to learn that buds are formed *as a rule* in the axil * of leaves, and that whatever grows from a bud is a branch of some sort ; all of which facts must be learned by actual observation.

Short Papers and Notes.

Re-Mounting Balsamed Objects in Fluid.

By A. L. Woodward.

SOME time since a friend gave me a mount of a spray of marine alga, bearing *in situ* a number of valves of *Hyalodiscus,* both *H. maximus* and *H. subtilis.* It was a balsam mount, and as is usual with objects of that kind mounted in such a medium, very much of the structural detail of the alga and of the attached diatoms was obliterated. It was entirely valueless for paraboloid illumination in its then condition, and after thinking the matter over, I determined to attempt to re-mount it in fluid. Accordingly I warmed the slide over a spirit lamp until the balsam was sufficiently

* That is, the upper angle formed by the leaf and the stem.

softened, so that I could insert the point of my penknife under the cover, raise it up and turn it over. I then picked up the spray of seaweed with a pair of fine forceps, and dropped it into a bottle of clean benzol, where it remained about ten minutes. From the benzol it was then transferred to cajeput oil, and from thence into alcohol. After a short immersion in the alcohol it was removed to a covered saucer of filtered soft water. I then took a slide having upon it a shallow cell of gold size and lamp black, placed it upon the turn-table, and run a light ring of fluid benzol-balsam around the top of the cell. Breathing upon the cell, I filled it with a solution of salicylic acid in water, and then took the alga from the water with the forceps, placed it in the cell and floated it out flat. A cover-glass was then applied, the surplus fluid was taken up with a bit of blotting-paper, and when the outer surface was dry another layer of balsam was applied. Upon putting the mount under the microscope it was found to have undergone a remarkable change. The alga stood out sharply defined, and with all its structural details visible. Some valves of *Isthmia* were perfectly filled with fluid, and showed their mode of attachment and growth very clearly, and the box-like form of the *Hyalodiscus* valves were beautifully displayed.

Nothing new is claimed for any of the details of the experiment. The credit for the idea of using salicylic acid solution as a mounting medium for marine algæ belongs to Mr. H. F. Atwood, F.R.M.S., and the only object of this communication is to call attention to the advantages of a fluid like the foregoing over balsam for mounting algæ when it is desired to display diatoms growing parasitic thereon.

Marine algæ dried in the usual manner will swell out and assume their natural appearance after soaking for an hour or so in strong salt water, and may then be transferred to fresh water and mounted in the salicylic acid solution. Every adhering diatom valve will be filled, and will display its structure, so far as can be learned from the uncleaned valve, very clearly.

Sections of Teeth.

By Dr. W. C. Brittan, Detroit, Michigan.

Very beautiful sections of the jaws of small animals with the teeth *in situ* may be made in the following way:—The jaws of a well-injected animal are placed for a few days in 50 per cent. alcohol, then into absolute alcohol for about two weeks, then with a sharp fine file cut away the bone from both sides of the jaw where the section is desired, until, by holding to the light, the

pulps of the teeth are visible, carefully keeping the piece and the file wet with alcohol during the operation. Thoroughly wash the piece with a soft brush in alcohol, and place in oil of cloves for a few hours, or until clear. Then transfer to a very thin solution of balsam in benzole, gradually thickening the solution from day to day by adding pure balsam until the tissues are thoroughly permeated. This is an important part of the process, and should not be hurried. Now place the piece in some shallow dish, and add pure balsam enough to cover it, and evaporate to hardness, being careful not to raise the heat above 110° F. When the balsam is hard the section may be worked down to suit. The balsam will hold the soft parts in position while this is being done; use water as a lubricant for this part of the work. The section made to suit, dissolve out the balsam with benzole, place in absolute alcohol for a day, clear again in clove oil, and mount. Sections made in this way are necessarily somewhat thick, for the reason that the different parts which are desired to show in the section seldom lie in the same plane, consequently they are best mounted in a cell ground into the slide which allows the cover-glass to be brought down close, and making a handsome job when finished. The method may seem somewhat tedious, and certainly requires some patience, but the result more than repays for the trouble. Dammar will be found the best medium for mounting.—*The Microscope.*

The Defences of Plants.

Most of us regard the world of plant-life as a huge collection of beings which hover on the verge of existence, and at best only "vegetate" in place of living the free and active existence of the animal kingdom. This view of matters, however, would appear to represent opinions which are in a state of rapid dissolution, if recent science as well as research of this tolerably advanced age are to be trusted. Persons learned in things biological tell us that plants are by no means the stereotyped units they have been regarded by popular philosophy. We hear of plants that feel, and of others which shrink on the slightest touch, and only expand their sensitive leaves after an interval has elapsed, and after the irritability of the living tissues has been appeased and mollified. We read of others which lay wary traps for insects, and which, imitating the *rôle* of the spider, capture, by aid of cunning contrivances, the unsuspicious fly. The Venus' fly-trap thus spreads open its leaf as an inviting surface for insect visitation, and closes its frond upon the winged visitor which has touched the sensitive hairs that

rise from the plant's foliage. Nor is this the whole story of plant-sensitiveness. The Venus' fly-trap does not capture insects for amusement, but for use, and as a part of the business of its proletariat. It eats and, what is more, digests the fly it captures, and this by a process which, botanists tell us, closely resembles digestion in ourselves. In like manner the sundew of our bogs and marshes catches flies and eats them—the animal falling a victim to the snares and wiles of the plant. Then come the pitcher plants, which visitors to Kew must have noticed, if for no other reason than that the leaves are marvellously modified to form hollow appendages which give to the plants their popular name. Within these "pitchers" flies and other insects in a state of decay are to be found. The pitcher plant itself is a kind of insect trap. Down into its slimy depths slips the fly which alights on its smooth and treacherous margin. With wings bedraggled and wet, the insect creeps up from out its prison-house to the light of day, only to find that an array of spines pointing downwards like a chevaux-de-frise, or a charge of fixed bayonets, impedes its course to the outer air. And so the fated insect falls back into the plant-pitcher, is speedily suffocated amid the fluid which that receptacle contains, and adds its body to the decomposing material which previous victims have gone to provide. From this decaying solution—this literal insect soup—the pitcher-plant appears to draw much of its nutrition.

In respect, however, of the defences which they present against foes and enemies of various kinds, many plants exhibit devices of no less ingenious nature than those by means of which they capture their food. In either respect we see how the vegetable world becomes lifted out of the rut of a dull, half-and-half vitality into the region of active life and labour. When plants grow old, as has well been pointed out, they tend to protect themselves by reason of the density and hardness of the parts they develop. Contrariwise, the young parts of plants, illustrating structures of more tender nature, are often found to be specially defended by prickles, spines, thorns, and like contrivances. What, for example, are we to say to the defences of the appropriately-named "Wait-a-bit" thorn of Ethiopia, which grows spines of immense length, utterly impenetrable by man or beast? The lion himself does not venture to tackle this formidable plant. Each spine, sharp as a bayonet, and as thick and effective, wounds and lacerates any living body which comes in contact with it. Nor does this curious plant stand alone in its special mode of defence. Grisebach, a noted botanical authority, tells us that all desert regions are distinguished by the high development of thorny defences in their plants. Nature in such a case seems to run to spines and prickles, as if imitating in the merciless character of

her plant-life the barren features of the surrounding land. There is, however, one noticeable point in connection with the growth of spiny defences in plants. The thorns, as a rule, do not grow above the level commonly reached by animals which might crop the leaves for food. Plant-development is conducted evidently on lines of strict economy. "Waste not, want not," is a maxim which finds a frequent reflex in the ways of vitality. Nearly related to these bayonet-like defences are the stinging organs of plants. We have two species of nettles in this country which blister the skin and cause pain and smarting when they are unwittingly touched. The urticating organs in the nettles and allied plants are simply modified hairs, similar in nature to those seen on most leaves. The hair is hardened somewhat, and pointed above. Below there is a mass of cells forming a gland which secretes a fluid of acrid and poisonous nature. When we grasp our nettle we crush the hair and suffer no bad effects; but when we touch it lightly the hair is driven downward, the sharp point is broken off in the skin, and the acrid fluid is forced upwards into the tissues and produces therein the well-known inflammatory effects. The "survival of the fittest" is in one sense a grim commentary on the success of an ill habit, if we are to judge by the plentifulness of the nettle tribes amongst ourselves. But abroad these plants would appear to flourish with equal vigour and persistence. What is to be thought of the giant nettle of New South Wales, which may grow to a height of 120 or 140 feet, and which is provided with a poison fluid of proportionate virulence? Here the young leaves measure some 12 to 15 inches in breadth. Another Indian species produces in man, when its leaves are bruised, and when the irritant fluid escapes, a copious flow of saliva, and gives likewise all the symptoms of a severe cold in the head, as well as other untoward symptoms as the result of its sting. A Timor nettle is said to produce effects on man which last twelve months, so intense is the severity of its poison.

Passing over many cases of plant defence in which we find contrivances for repelling intruders on the vegetable domain, ranging in variety from glutinous secretions to bitter tastes, and odours aromatic or disagreeable to birds and other plant visitors, we may find more noteworthy examples of curiosities in the way of the repulsion of enemies. Co-operation is a principle not unrepresented in plant existence. There is a parasitic plant of Sumatra, for instance, which has established singular relations with colonies of ants. The insects inhabit the tuber of the plant, which itself is a parasite on trees. Within this tuber the ants burrow to form their nests and winding passages. As these insects sting very severely, it becomes clear that animals will be chary of meddling with their plant post. An association of almost similar

kind is seen in a well-known member of the Acacia tribe. Here we find spines of large size borne on the stem and branches. Below, each of these thorns is hollowed out, and in the receptacle thus formed ants are found. There is not merely a leaning upon the insect for defence in such a case, but also a decided preparation for the comfort and habitation of the defenders in the shape of the hollow spines, and also in the form of a large gland which manufactures the nectar on which the ants subsist. In return for defence, the plant offers board and lodging to the insects, and provides a free breakfast-table for their use. Since the days when a work on flowers and their unbidden guests was written, botanists have been enlarging our knowledge of the often quaint and marvellous ways in which plants, while inviting certain insects for purposes of fertilising their flowers, protect themselves against invasion by other and undesirable insect guests. Ants are abhorred, so to speak, by the majority of plants. They steal the honey, but afford no benefit to the flowers in return. Hence, plant nature protects itself in this sense against the ants, as in another sense it invites these insects for protection. Thus in the teasel, there are cups at the bases of the leaves, filled with water, and presenting impassable barriers to ants which may try to ascend the stem. In the pineapple leaves a similar arrangement is found. Sticky organs catch and kill ants, as in the "catch-fly," and the willow has slippery stalks to its flowers, which try and defeat any acrobatic impulses with which ants may be attacked or impelled. Yet the insect is sometimes equal to the task of circumventing the defences of the plant. There is an alpine variety of the monkshood which is fertilised by bumble bees. But one bee, instead of legitimately taking the honey from the front of the flower, and of thus aiding the work of plant-fertilisation, actually bites a hole in the back of the flower, and abstracts the honey, without in any sense benefiting the plant. There is, however, another variety of this flower, which, having a bitter and acrid taste, is left unassailed by these insect thieves. The whole topic is full of interest to every lover of nature; and the subject is none the less interesting, because in so many ways it shows reflections of a prudence and wisdom that find their analogues in many of the contrivances wherewith man protects his own interests in the world of higher life.—*Daily News.*

Useful Glue.

A glue useful for repairing all kinds of articles, and one that will always be ready for use, may be made as follows:—Dissolve 8 ounces best glue with half-pint of water, and add slowly 2½ ounces strong aqua fortis (nitric acid), 36° Baume, stirring all the while, keep well corked.—*Scientific American.*

To Preserve Cut Flowers.

Flowers may be preserved for many months by dipping them carefully, as soon as gathered, in perfectly limped gum water; after allowing them to drain for two or three minutes, arrange them in a vase. The gum forms a complete coating on the stems and petals, and preserves their form and colour long after they have become dry.—*Scientific American.*

Musical Fishes.

Speaking of the Musical Perch of the Ohio river, a correspondent of the *Scientific American* says:—"The humming or singing is produced by two corrugated bones in the mouth or throat, which they rub together, and the sound is on the principle of the violin or musical glasses. I intend as soon as I can get a good specimen to dissect it, or have it done, and hope to give you an item, as I do not think it has ever been noted in any work or paper.

Double Daisies.

The following appears in a book recently published by a well-known writer on scientific subjects:—"And always, when Daisies are planted in rich soils, and kept clear of competition, as in our gardens, they become *double*—*i.e.*, the tubed florets of their disc are converted into strap-shaped ones, like those of the 'ray.'"

Can any of your readers inform me if they have ever known any such improvement to be effected? I have been gardening in the country for thirty-three years, and never yet saw a common daisy—*Bellis perennis*—in the least changed by surroundings such as the author quoted describes. I have always understood that the double daisies of our gardens are the produce of one of those monstrous growths which make their appearance sometimes, such as the "teratological" varieties of ferns. The fact of the peculiarity being permanent in the descendants is scarcely a proof that plants can be altered at the will of the cultivator.

H. W. Lett, M.A.

Notonecta Undulata, an Enemy of the Gold Fish.

By Dr. T. S. Stevens.

In the spring of 1884, I had a small globe containing two vigorous, healthy gold-fish (*Carassius auratus* L.). Into this I dropped a water-boatman (*Notonecta undulata*, Say), a little fellow not much more than half-an-inch in length; but, as the sequel will

show, not only do these predacious little insects prey upon other aquatic insects, but under certain circumstances they will attack larger game, and may be a source of annoyance and death to the fish in the ponds where they abound. In a day or two after I had placed the *Notonecta* in the globe, I found one of the fish dead, which I removed, thinking it had died from natural causes. A few days later I found the other fish dead, with the *Notonecta* clinging to it near the gills, evidently sucking its juices. I lifted the fish from the water, with the insect still clinging to it. The *Notonecta* not releasing its hold when I gave the fish a vigorous shake, I attempted to remove it with my fingers. No sooner had I broken its hold on the fish than it drove its sharp beak into my finger. The pain was sharp, like the sting of a bee, but soon passed away. I then felt convinced that my gold-fish had been the victim of the little *Notonecta*, and to test the matter, after subjecting it to a week's fasting, I placed in the globe with it another vigorous gold-fish, and watched the result. In the course of half-an-hour the insect had fastened itself on the fish, near the gills, causing it to dash around the globe in evident pain and distress. I was here called away from my watch, but on returning in about an hour, I found the fish swimming slowly on its side, apparently dying. I lifted it from the water, the *Notonecta* still clinging to it. After removing its tormentor, taking care not to use my fingers, I replaced the fish in the water, where it soon regained its vigour, and lived for months after. Whether it is the habit of this insect to prey on and destroy small fish when at large, I do not know, but I have no doubt both as to its inclination and ability to do so when in confinement, and removed from other prey.—*Journal of the Trenton Natural History Society.*

A Hint to Amateur Wood Carvers.

In producing relief it is not necessary to cut away the ground of the wood to the depth of the design in relief, as a portion of the thickness necessary may be obtained by glueing on extra thicknesses of wood.—*The Furnisher and Decorator.*

Gigantic Trees of New South Wales.

In Fearnshaw, a mountain glen about twenty miles from Sydney, near the rise of the Yarra river, are to be found the largest known trees. Here the Eucalyptus, or Gum tree, exceeds by a hundred feet the highest of the Conifers of the Yosemite Valley. The clean stems rise 200 feet, like the "tall masts of some great Admiral," before the lowest branch strikes out from

them. One drives as through the aisles of an immeasurable cathedral, the boughs joining overhead to form the roof, supported on the grey columns which rise one behind the other all around. There is no undergrowth save tree-ferns, fine in their way, for some of them were thirty feet high, but looking like mere mushrooms among the giant stems. Three hundred and fifty to four hundred feet is their average height—one was measured which reached four hundred and sixty. In the glen in which they stand they are sheltered from all possible winds. To this, and to the nature of the soil, they owe their enormous development. The girth of one at the height of a man's shoulder was forty-five feet (Froude's "Oceana," pp. 145—147. BETA.

A Pine Tree Growing Acorns.

Near a plantation home, which is situated eight or ten miles from Washington, Ga., stands the tree which bears the unnatural fruit. The tree is an ordinary medium-size specimen of its kind, and to a person standing twenty steps away, would attract no special attention among the others standing thickly grouped about it. A nearer inspection, however, would reveal its remarkable identity. Thickly perched upon every twig and bough are to be seen these acorns, varying in size, the same as they flourish on their parent stem, the oak. Interspersed here and there upon the tree are the original pine burs. It is considered a most remarkable freak of nature. No plausible reason can be given for the amalgamation, and cannot in any way account for the hybrid state thus established. The tree with the acorns on is there to show for itself.—*The Decorator and Furnisher.*

Answers to Queries.

30.—Coal.—Preparations of coal from the carboniferous strata—the Dyas and Trias—the material of which is very difficult to reduce to thin and sufficiently transparent sections, are made by using the finest emery employed in polishing mirrors; powdered chalk obtained by levigation, and carbonate of lime precipitated from lime water by soda, are also used. A small piece of cork serves as a rubber. During the process the preparation is moistened with glycerine. V. A. L.

46.—Air Bubbles in Botanical Mounts.—If "F. E. C." will place his botanical sections for a few minutes in clean soft water, which has been *recently* boiled and allowed to cool, he will find that he can then carry them forward into glycerine or glycerine jelly, without fear of bubbles. The newly boiled water has a powerful affinity for air, and what little may be contained in the section will still act after the cover-glass is on. A. L. W.

66.—Schizonema Grevillei.—If it is desired that fresh specimens of these diatoms should exhibit, as closely as possible, the appearance presented by the living plants, they should be put up within cement-cells in aqueous media, as distilled water saturated with camphor, carbolic acid, salicyclic acid,in the small proportion that will dissolve in cold water; for coarser structures, a stronger solution should be used; it may be made by combining with the acid a small quantity either of borax dissolved in glycerine or of acetate of potash. Glycerine, Hantsch's fluid, and Farrant's medium may also be used, but if not mounted within a short time after they have been gathered, about one-tenth part of alcohol should be added to the water. Deane's medium is used to show the stipitate forms in their natural parasitism on other aquatic plants; or they may be mounted in glycerine jelly, when they make a very beautiful object for spot-lens illumination. I would advise the reading of Quar. J. M. Science, Vol. vii. (1859) p. 167, and Vol. i. (N. S., 1861), p. 143, and Trans. of Roy. Micros. Soc., Vol. xi., (N. S., 1863), p. 4. Mr. FitzGerald should obtain "Practical directions for collecting, preserving, transporting, preparing and mounting diatoms" (N. York, 1877); a good series of papers by Professor Edwards, Johnson, and H. L. Smith.

V. A. L.

67.—Diatoms.—One of the most complete works on the preparation of Diatoms for the microscope is a collection of three American pamphlets, by Edwards, Johnson, and Smith, which may be obtained for about 3s. 6d., of Mr. W. P. Collins, of 157, Great Portland Street, London. The little book of Mr. Thomas Davies (published by W. H. Allen), on the mounting of Microscopic Objects, may be consulted with advantage, as also the remarks on Diatoms in Mr. G. Davis's Practical Microscopy. The articles by Mr. Griffin in the third volume of the "Journal of Microscopy and Natural Science," contain a great deal of useful information as to the collection and preservation of Diatoms. I doubt if there is any book of an elementary character on the nature and classification of Diatoms generally. Smith's British Diatoms, though not elementary, is probably the best for a beginner, but is rare and can seldom be obtained for £6. Mr. Collins's Catologue contains several books on the subject, from which a choice could

be made. Dr. M. C. Cooke's shilling book, "1,000 objects for the microscope," which every microscopist should possess, contains a list of over 100 of the most interesting forms of Diatoms. A considerable amount of work may be performed amongst diatoms with a good quarter-inch objective, and an eyepiece giving a power of about 300 diameters. E. S. COURROUX.

73.—Poisons of Fungi.—"A *full* account of the nature and properties of the poisons which are found in fungi," has not yet been written. There are several paragraphs, beginning with 249, in Berkeley's Introduction to Cryptogamic Botany on the subject, and a good deal in Cooke and Berkeley's Fungi, published in the International Scientific Series. Also in G. Worthington Smith's Edible and Poisonous Fungi. It appears from the above authorities that the Fly Agaric, *Agaricus* (Amanita) *Muscarius*, is used in parts of Russia merely as an intoxicant, and not as an article of food, just as alcohol is elsewhere employed. Some at least of the poisons of Fungi are volatile, as the heat of cooking renders certain species palatable and wholesome. H. W. LETT, M.A.

75.—Dead Birds.—I fancy that the Burying Beetles will supply the solution to this somewhat ambiguous question, and that the vast numbers of non-migratory corpses referred to in it are put out of sight by their means.

The Rev. J. G. Wood, writing of the *Necrophagæ*, says:—"It is owing to the exertions of these little scavengers that the carcases of birds, small mammals, and reptiles are never seen to cumber the ground, being buried at a depth of several inches"; and the same author, in his work "Homes without Hands," writes: "In some cases they (the Sexton Beetles) will bury a whole series of corpses, and in the well-known experiments of M. Gleiditsch, four beetles buried in a small piece of earth, four frogs, three birds, two fishes, one mole, two grasshoppers, the entrails of a fish, and two pieces of meat. And so strong and persevering are these insects, that a single beetle succeeded in burying a mole in two days." Louis Figuier, in "The Insect World," tells us that, "When the ground is too hard to be dug the *Necrophori* push the carcase further, till they find permeable soil," and Dr. Duncan in his "Transformation of Insects," mentions that "These beetles (*Necrophorus Vespillo*) are remarkable for the subtle sense of smell they possess. They fly swiftly and are constantly hunting, with the aid of their acute sense of smelling, for the dead bodies of animals." E. K.

81.—Canada Balsam.—I have never found any difficulty in thinning Canada balsam with benzole, but I always use the very best. The inferior benzine sold for removing grease spots from

clothing, etc., and sometimes benzole will not answer; some sorts will not even dissolve the Canada balsam, while others will, while combining with it, render it milky or muddy looking. I cannot imagine what the "darkening" alluded to can be except the opacity I mention, and which I have proved by experiment to be caused by the spurious benzole. H. W. LETT, M.A.

87.—Asphalt Varnish.—Not being able to perceive any difference between black varnish and asphalt varnish, both of which I possess, my reply on page 89, about the former, will answer "Mac" regarding the latter. I once used asphalt varnish for fastening the cells and covers, and soon found all cemented by its giving way, and now I make my cement for such purposes, and also for shallow cells in which to mount Desmids and other fresh-water Algæ in fluid, of three parts gold size, and one part asphalt or black japan varnish, and there is nothing like it; it never fails. H. W. LETT, M.A.

89.—Classification of Slides.—The only one of the names you mentioned which I actually know is Plexaura. This is one of Lamouroux's Divisions of *Pterogorgia*, which is a subgenus of the genus *Gorgonia* belonging to the *Gorgonidæ*, one of the families of the *Alcyonaria*, an order of the class *Actinozoa*, sub-kingdom *Cœlenterata*. The *Gorgonias* contain the fleshy fan corals with horny axes. I have no doubt, that *Litogorgia* and *Billogorgia* are also Gorgonias. *Junculla* and *Meliloides* probably the same. Dana's great work on corals is the book to refer to.

J. G. GRENFELL.

91.—Cuticles of Leaves.—To display the siliceous structure of *Deutzia scabra*, it is necessary to cut very thin slices from the cuticle, and mount them in fluid or Canada balsam. They may be obtained by prolonged maceration in pure water. I boil the leaves in a test-tube with Nitric acid and water, until both the upper and under cuticles appear to separate; transfer the piece of leaf to a vessel of pure water, well wash it to free it from the acid; if the cuticle is very delicate it may be transferred to a glass slip at once. Let it lie on the slip with inner side upwards, then with a camel-hair brush and water wash away all extraneous matter, leaving the cuticle clean. Place now in a watch-glassful of alcohol until ready to mount, which may be in fluid or balsam, according to the nature of the object:—if siliceous and for polarised light in Canada balsam or Dammar; if leathery, as the cuticle of *Polypodium vulgare*, in glycerine. If the leaf is fleshy, use more water than acid; if thick, leathery, or siliceous, nearly or quite pure acid must be used. When siliceous, after it has been separated by using pure acid, do not allow it to dry entirely, or it will be diffi-

cult to mount well; transfer therefore quickly whilst moist to alcohol, then to benzole, next to turpentine, and mount in Canada balsam or Dammar. To prepare the siliceous cuticle of *Equisetum, hyemale*, separate it with Nitric acid, and wash well in warm water, then take a glass slip and on the centre of which place a very thin layer of mucilage, formed from gum tragacanth, so that the cuticle will fit on to it as nearly as possible. Place the cuticle accurately, and do not move it again; over this place another slip, previously slightly greased to prevent it sticking; then put the slips between a clip. When the cuticle is dry remove the top slip, and allow the cuticle to be well soaked with turpentine. At the same time the edges can be cleaned and trimmed with a sharp scalpel. Drain off the superfluous turpentine, and drop a small quantity of Canada balsam on to the cuticle, then cover and press it down. Place to dry, clean and label. It may be mounted without gum, but on drying is very liable to curl and separate from the slip. It may also be mounted in a cell with glycerine. V. A. L.

92.—Bumble Bees and Moss.—The bumble bees you mention are probably the *Bombus Muscorum.* They use moss to build their nests with, and hence are called "Carder Bees." Although they tear up a large amount of moss, the quantity that they use for building is comparably very inconsiderable. H. S. Montgomerie.

93.—Ringing Slides.—If H. E. H. will give his balsam slides two coats of good "Painter's Knotting," he will have no further trouble with the zinc white or coloured cements running in. This is what I have used for some years, and it works well.

Henry Vial, Crediton.

95.—Bot Fly.—During the months of July and August the *Œstrus* frequents pastures and deposits its eggs chiefly on the shoulders and knees of horses.

In order to do this, the female suspends herself in the air for some seconds over the spot she has chosen, falls upon it, and with her abdomen bent, sticks her eggs to the horse's hairs by means of a glutinous liquid, with which they are provided, and which soon dries. It often happens that from four to five hundred eggs are thus deposited upon the same horse.

Guided by a marvellous instinct, the female *Œstrus* generally places her eggs on those parts of the horse's body which can be most easily touched with the tongue, that is, at the inner part of the knees, on the shoulders, and rarely on the outer part of the mane.

The eggs are white and of a conical form. They are furnished with a lid, which at the time of hatching opens, to allow the exit of the young larva, about twenty days after the eggs are deposited.

It is not in the egg state, but really in that of the larva, that the horse, when licking himself, carries these parasitical guests first into his mouth, and afterwards with his food into his stomach. (It is a remarkable fact, that it is sometimes other insects, as the *Tabania* for instance, that by their repeated stinging cause the horse to lick itself, and thus to receive his most cruel enemy.) In the perilous journey they have to perform, from the skin of the horse to his stomach, many of the larvæ of the *Œstrus*, as may be supposed, are destroyed, ground by the teeth of the animal or crushed by the alimentary substances.

There is hardly one in fifty that arrives safely in the stomach, and yet if one were to open a horse which had been attacked by the *Œstri* the stomach would be nearly always found to contain many of the larvæ sticking to its inside. The larvæ are of a reddish yellow, and each of their segments is armed at the posterior edge with a double row of triangular spines, large and small, alternately, yellow at the base and black at the point, which is always turned backwards. The head is furnished with two hooks, which serve to fasten the larvæ to the internal coats of the stomach. The spines, with which the whole surface of the body is furnished, contribute to fix it more perfectly, preventing the creatures, by the manner in which they are placed, from being carried away by the food which has gone through the first process of digestion. It is probable that these larvæ are nourished by the mucus secreted by the mucus membrane of the stomach, and that it breathes the air which the horse swallows with its food during the process of deglutition.

It must be acknowledged, however, that it is in the midst of a gaseous atmosphere which is very unhealthy, for nearly all the gases generated in the stomach of the horse are fatal to man, and to the generality of animals, as they consist of nitrogen, carbonic acid, sulphuretted hydrogen, and carburetted hydrogen.

M. Jolly has suggested the following ingenious hypothesis, to explain how the insect can live under such circumstances :—

"When the stomach which the larvæ inhabits contains only oxygen or air that is nearly pure, the insect opens the two lips of the cavity which contains the spiracles, and breathes at its ease. When the alimentary substance generates gas which is unfit for respiration, or when the spiracles run the risk of being obstructed by the solid or liquid substances contained in the stomach, it shuts the lips, and continues to live on the air contained in its numerous trachæ." Arrived at a state of complete development, the larva of the *Œstrus*, imprisoned in the stomach of the horse, leaves the membrane to which it has been fixed, then directing the anterior part of its body towards the pyloric opening of the stomach, allows itself to be carried away with the excrementitious matter.

It traverses, mixed with the excrementary bolus, the whole length of the intestinal canal, leaves it by the anal orifice, and on touching the ground, at once seeks a suitable place to go through the last but one of its metamorphoses. The skin then gets thick and hardens, and becomes black. All the organs of the animal are composed of a whitish amorphous pulp, which soon assumes its destined form, and the insect becomes perfect. It then lifts a lid at the anterior part of its cocoon, emerges, dries its wings, and flies off.

The whole of the above is from Louis Figuier's "Insect World." In speaking of the *Œstrus equi*, the Rev. J. G. Wood says: "They do not seem to inflict any damage upon the animal from whose bodies they have drawn their nourishment, and some veterinary surgeons believe that they are rather beneficial than injurious." E. K.

Queries.

96.—Petroleum.—Can any of your readers give any information as to the "Origin of Petroleum"? Is it a decomposition of coal, or what? T. G. J.

97.—Kerosene.—What is the Kerosene oil of which the Americans talk so much? Is it what we commonly call Paraffine, or is it Benzoline? S. B.

98.—Double Nose-Piece.—Which of the various changers or double nose-pieces at a moderate price is the best for students to use? MICRO.

99.—Diatoms.—What is the best bleacher for Diatoms, to be used when boiling? A. T.

100.—Retina.—We are told that all objects are imprinted on the retina in an inverted position. I should like to know, if this is so, why do they appear the right way up to the senses? Surely, the doctrine of experience and habit cannot be a satisfactory reply to the above. OPTIC.

101.—Series of Objectives.—What objectives will constitute the best working series for practical use, but especially in Histology, with A, B, C, and D eye-pieces respectively? B. S. A.

102.—Length of Microscope Tube.—Where shall we commence to measure to obtain what is called a standard length of a microscope tube? D. E. M.

103.—Sharpening Knife for Section Cutting.—What is the best method of sharpening the knife for cutting vegetable sections? E. S.

104.—Bleaching Bones.—I shall be glad if any of your readers will tell me how to bleach bones. I have a number of cleaned human and other bones, but I wish to whiten them for cabinet specimens. C. D.

105.—Saccharin.—In last June's number of *Chambers's Journal*, a reference is made to a Saccharin obtained from coal-tar in Germany. Can one procure a specimen of this Saccharin anywhere in this country? E. K.

106.—Bile.—How far are the elements of bile contained in the blood poured into the liver, and then separated by the liver-cells? Also, how far have these cells a formative power? V. A. L.

107.—Deposit on Vegetable Cell-Walls.—Has any external deposit on vegetable cell-walls ever been proved to take place? S. E.

108.—Age of Animals.—So few natural-history books, after giving an accurate description of the habits and colouring of a bird or beast, make any allusion to their average longevity, can any reader supply any information as to the average length of life of some of the more common birds and beasts, wild or domesticated, in confinement or otherwise? E. K.

Assisting Naturalists.

If you will place my name on this list, I shall be glad to be of use in the following departments:—Conchology (Land and Fresh Water); Micro-Fungi; Phanerogams.

H. P. FitzGerald, North Hall, Basingstoke.

[We hope other friends willing to assist will send in their names as early as possible.—Ed.]

Reviews.

How to Photograph Microscopic Objects, or Lessons in Photo-Micrography for Beginners. By J. H. Jennings, late Assistant-Master of the High School, Nottingham. (London: Piper and Carter. 1886.) Price 3s.

This is No. VIII. of the very useful series of "Photographic Hand-books," published at the *Photographic News* office, and gives simple and plain instructions for the production of pictures from microscopic objects. The book is

divided into fifteen chapters, one of the most important being by Dr. R. L. Maddox on the Method of Preparing and Photographing Bacteria, and another on the Detection of Arsenic in Fabrics and Photographing Deposits of Arsenous Acid.

PHOTOGRAPHY FOR AMATEURS: A Non-Technical Manual for the Use of All. By T. C. Hepworth, Lecturer to the late Royal Polytechnic Institution. Second and enlarged edition. (London: Cassell and Co. 1886.) Price 1s.

To all those who are about to commence the practice of Photography in their leisure hours we have much pleasure in recommending this little book. The instructions will be found very plain, and, as far as practicable, non-technical. Besides Landscape Photography and Portraiture, it gives instructions for the production ot Magic-Lantern Transparencies, Enlargements, etc. It is, besides, very nicely illustrated.

THE CAMERA is the name of a new Monthly Photographic Magazine. Judging from the first number, we think it is sure to prove very acceptable both to the amateur and the professional photographer. It is published by Wyman and Sons, Great Queen St., W.C., at 6d.

MONOGRAPHS ON EDUCATION.—Messrs. D. C. Heath and Co. (Boston, U.S.A.) propose to publish, from time to time, under this title, just such essays, prepared by specialists, choice in matter, practical in treatment, and of unquestionable value to teachers. They will be bound in paper covers, and sold at low prices. No. 1 of this series will be a paper on *Modern Petrography.* An Account of the Application of the Microscope to the Study of Geology, by George Huntington Williams, of the Johns Hopkins University, will be ready very soon.

To Correspondents.

We would remind our friends that a number of Queries remain unanswered. All communications should reach us not later than the 10th of the month.

Sale and Exchange Column.

The Scientific Enquirer.

SEPTEMBER, 1886.

*The Study of a Few Common Plants.**

By George L. Goodale.

III.—Roots.

1.—THEIR MODE OF GROWTH.

As we have seen in the examination of seedlings and cuttings, roots can start from different points of the stem. In some cases, they can arise from the leaf-stalk or even from the leaf-blade itself. The root, whatever its origin in any case may be, grows in length only in one way; namely, at a point just behind its very tip. This growing point is usually protected by a peculiar cap, which insinuates its way through the crevices of the soil. If roots should grow as stems escaping from the bud-state do—that is, throughout their whole length—they would speedily become distorted. But, since they grow at the protected tips, they can make their way through the interstices of soil, which from its compactness would otherwise forbid their progress.

That roots grow in length only in this way can be easily proved by a simple experiment, which can be left to the management of the student. Let a young seedling of Indian corn be grown on damp paper in the manner described in Part I., Chapter 1, and, when the longest root is a few centimetres long, let it be marked very carefully by means of India ink or purple ink, put on with a delicate camel's hair pencil, by lines just one centimetre apart. The plants thus marked are to be kept under favourable conditions with respect to moisture and warmth, so that the growth will be as rapid as possible. The marks on the older part of the root will not change their relative distance, but the mark at the tip will be carried away from the one next to it, showing that the growth has taken place only at this point. Such experiments as

* From "Guides for Science Teaching."

the one just described are perfectly practicable for all classes of students except the very youngest.

The branching of roots never seems very symmetrical at first sight, but that there is sometimes an obscure order underlying the arrangement can be made clear by the water culture referred to under Part I., Chapter 1. Concerning the thickening up of roots as store-houses for food, nothing will now be said.

2.—THEIR WORK.

If the roots of the youngest seedlings of wheat or flax are carefully examined, they will be seen to be covered, except near the tip, by a very delicate down, made up of extremely fine hairs. These are the root-hairs, which serve to take up the water-food for plants. They are so exquisitely delicate that the slightest touch crushes them ; and, if the plant is lifted from the soil, all the root-hairs are left behind, or else a few hold fast to finer particles of soil which are brought away.

Of course, a microscope is very necessary in any careful examination of root-hairs ; but the hairs can be seen without one in the cases mentioned, and in some others where they are looked for carefully. It is these root-hairs, and not the very tips of the roots, which absorb water. This can be studied practically in the way pointed out by Ohlert, a German school-master, who first published, in 1837, an account of root-hairs. The tips may be carefully removed, and the wounds painted over, and the roots placed again in water, where the hairs can have a chance to absorb, if this is their office.

Root-hairs are found only on the newer parts of roots ; and these are therefore the only active absorbents of dilute aqueous solutions. But if, on the other hand, a rootlet of duckweed or other water-plant be examined, it will be found to have neither root-hairs or root-cap, the whole structure being capable of absorbing nourishment from the water.

IV.—LEAVES.

The dilute solutions just spoken of are carried through the older parts of the root up to the stem, and through the stem to the leaves and other green surfaces. Here some very interesting changes take place, which can be made plain, even to young students, if they have faithfully worked out the subjects up to this point.

Green leaves are generally so constructed that water evaporates readily from their substance. This exhalation (although it is something more than mere evaporation) can be shown by a very simple experiment, devised by Professor Henslow, and which will be described in the words of Professor Oliver's Botany, p. 15 :—

" Exposure to sunlight, as well as dryness of the air, has to do

with this evaporation of water from the leaves. Take six or eight of the largest, healthiest leaves you can find, two tumblers, filled to within an inch of the top with water, two empty, dry tumblers, and two pieces or card, each large enough to cover the mouth of a tumbler. In the middle of each card bore three or four small holes, just wide enough to allow the petiole of a leaf to pass through. Let the petioles hang sufficiently deep into the water when the cards are put upon the tumblers containing it. Having arranged matters thus, turn the empty tumblers upside down, one over each card, so as to cover the blades of the leaves. Place one pair of tumblers in the sunshine, the other pair in a shady place. In five or ten minutes examine the inverted tumblers. That exposed to the sun you will find already lined with dew on its cool side, while that kept out of the sun is still nearly or quite clear. It is manifest, therefore, that evaporation from the leaves must not be only rapid, but considerable in amount, when plants are exposed to the sun or a dry atmosphere."

By the evaporation, or transpiration, as it is called, which goes on from green leaves, the dilute solutions which have been raised to the foliage become more concentrated. The transpiration is governed largely by delicately balanced valves, which are found chiefly on the under surface of the leaves. These valves, or *stomata* as they are called, are openings which lead into the spaces formed between the cells of the plant, and may be easily seen by taking off the thin transparent skin (*epidermis*) which covers the leaf of the white lily, placing it on a piece of glass, and carefully observing it with a good lens. They are so large in this plant that they may easily be seen without a compound microscope.

Within the tissue of green leaves, there can be found under the microscope, granules of a leaf-green substance called chlorophyll. Under the influence of sunlight, carbon dioxide, a gas which exists as an impurity in the atmosphere, and which is readily taken up by green leaves, undergoes, together with the water within the leaf, changes which end in the formation of starch or something very much like it. While such an operation is going on, oxygen is given off by the leaves. The relation of oxygen and carbonic dioxide to animal respiration should now be considered, as the evolution of oxygen from green leaves only goes on in the daylight. In all its kinds of activity, except that of leaf-green in sunlight, the plant takes in oxygen and gives off carbon dioxide. But the work of leaf-green in sunlight—namely, the conversation of inorganic matter into organic substance—is the chief work of the common plants about which we have been studying. This work is *assimilation.* The description of this process, and its relations to growth, are very clearly stated in Dr. Gray's "How Plants Grow," and in his "Lessons in Botany."

The assimilated product made by green leaves in sunlight is stored up in many forms and in many places, such as roots, stems under and above ground, leaves, and seeds. It is used for many purposes, chiefly the following: making wood, and the like, building up new parts, forming flowers, and making seeds. Some of these kinds of work are to be briefly examined.

To sum up the work of green tissues, whether on the stem or in leaves themselves, it may be said that they lift dilute solutions from the roots to the light and air, there concentrating them; that they are the factories where starch or something very similar is made. To endeavour to understand the many beautiful adaptations to these purposes by different exposures, positions, and shapes, will furnish the student with very abundant subjects for most interesting and important study.

If a dining- or bedroom window has plenty of plants with green foliage, some of them will exhibit movements of leaf-stalks and stems in response to light, and these movements are well worth watching.

Lastly, it may be said that, although plants give off carbon dioxide in the dark, the amount is trifling, and in the case mentioned above cannot seriously affect the atmosphere of the room. The windowful of plants can do no harm. Plants take in oxygen and give off carbonic acid throughout their whole life, both in the sunshine and in the dark, this is a true breathing process, whilst that mentioned above of assimilating carbonic acid and giving off oxygen is not breathing but feeding.

Short Papers and Notes.

The Acorn Barnacle (Balanus).

IT is quite worth the trouble, when wandering over sea-cliffs or rocks, in the summer season, to make a study of one or two of the common forms of life that abound there; for with the aid of the microscope, and with increased intelligence as to their beauty and mechanism, they turn out to be no longer common, but a part of the most wonderful works of Nature. What more plentiful than the "Acorn Barnacle"? Studded over the rocks, we cannot help treading on them, as we would upon newly-fallen hailstones, and yet at every footstep we crush numbers of living organisms that are worth inquiring about. Every Barnacle, or "cone-shaped tubercle," is a properly-developed shell,

consisting of eight valves, sometimes so firmly soldered together, that they require to be treated with acids before they will separate. The method in which it catches its prey is the most interesting fact about the creature. Along the under side of the body are set six pairs of legs, which are developed at their extremities into two long-jointed filaments, covered with hairs, or *Cirri*. It is by means of the continuous action of these limbs that the Barnacle secures its food. If one is watched, the top of the cone will be seen to open, a fairy-like hand is thrust out, the fingers extended by making a grasp at the surrounding water, the hand closed, and then withdrawn into the shell. This hand is really the collected mass of legs, with the appended filaments and *Cirri*. The Barnacle passes through many transformations before it is a fixed animal, and would seem to be of much higher organisation when young than when adult. When set free from the parent, they are very minute, but they are free, and if a microscope be applied to the water where they are, they appear to be extremely lively and happy. When young they possess eyes, which, when adult, are thrown off as useless to a fixed being. They also possess two large antennæ which assist the imperfect Barnacle to swim through the water, while they are the instruments which it uses to fix itself to the rock before undergoing its last transformation. A series of changes—when at every change the skin is cast—brings the Barnacle to resemble the Cypris, or Cyclops. When ready for the last change, it presses the antennæ against the rock. A strong cement is then poured from their bases, and the Barnacle voluntarily resigns its liberty. As soon as it is fairly settled, it casts its skin again, flings off the old bivalve shell which guarded it, dispenses with the eye, and assumes the adult form.

MINNIE MCKEAN.

The Polarity of Tadpoles.

The following, says the *Centralblatt fur Elektrotechnic*, is reported about an interesting experiment of the physiologist, Prof. L. Herman :—In a flat bowl, filled with water, in which a number of 14 days' old frog larvæ (of *Rana temporaria*) were disporting themselves, were sunk along the narrow side, ready for an experiment, thick zinc wires, connected with a battery of 20 little zinc-carbon elements. When the current was made, the whole of the little animals fell into a wriggling motion, which soon ceased. But all the larvæ, without exception, had taken up one position, in which the head was turned to the anode and the tail to the cathode. The animals remained in this position till the current was broken, when they fell again into the wriggling motion, but now less violently. Repeated experiments proved that the living

animals showed a decided polarity, placing themselves along the stream-lines of a current with their heads all in one direction, this direction being reversed when the current was reversed. An explanation of this interesting phenomenon has not hitherto been given.

A Curious Flower.

The *American Analyst* says that a curious flower was recently discovered on the Isthmus of Tchuantepec, Mexico. It has a faculty of changing its colour during the day. It grows on a tree. Another peculiarity of this floral chameleon is that it only gives out scent at noontime. One of the strangest things about this flower, however, is that it should be found in Mexico, when its colours are those of the United States flag. In the morning it is white, at noon it changes to red, and at night it adopts a soft-blue colour.

To Skeletonise Leaves.

First dissolve four ounces of common washing soda in a quart of boiling water, then add two ounces of slaked lime, and boil about fifteen minutes. Allow this solution to cool; afterwards, pour off all the clear liquid into a clean saucepan. When the solution is at a boiling point, place the leaves carefully into the pan, and boil the whole for an hour. Boiling water ought to be added occasionally, but sufficient only to replace that lost by evaporation. The epidermis and parenchyma of some leaves will more readily separate than others. A good test is to try the leaves after they have been gently boiling for about an hour, and if the cellular matter does not easily rub off between the finger and thumb beneath cold water, boil them again for a short time. When the fleshy matter is found to be sufficiently softened, rub them separately, but gently, beneath cold water until the perfect skeleton is exposed. The skeletons are at first of a dirty white colour. To make them of a pure white, and therefore more beautiful, all that is necessary is to bleach them in a weak solution of chloride of lime.

Transplanting a Tree.

We learn from an American paper that Colonel Walter C. Larned, the famous art connoisseur, has been in San Francisco for several weeks with an enterprise of no mean proportions. He wishes to transplant to the handsome lawn of his magnificent summer residence at Lake Forest one of the big Californian trees, and he has just closed a contract with the Wells and Fargo

Express Company to this effect. Special cars are to be constructed to transport the tree across the plains, and the umbrageous Leviathan will have to be drawn by horse-power after the Missouri river has been reached, because the obstacles in the way of railroad-curves and bridges east of that point cannot be overcome. The tree which Col. Larned has selected is somewhat over 300 feet in height, is 98 feet in circumference near the base, and weighs about 40,000 tons. The cost of transplanting this monarch of the forest will exceed $18,000, nearly £5,000.

Light.

One of the curiosities of light is the fact that the rays of the sun should pass through a cake of ice without melting it at all, as is the case when the thermometer stands a little above zero. That the rays of light actually penetrate the ice is shown by the fact that a lens of ice may be used for setting fire to inflammable substances.

The Star-Fish.

No animal is more common on the rocky coasts than the star-fish, and for this reason visitors to the seashore are very apt to pass it by, and search for the more attractive and rare sea-anemones. He is a restless creature when in an aquarium, and will continually rove about in search of something to eat. He moves about with a slow, regular motion, which at first seems mysterious. There is no irregular motion, as in walking, but simply a slow propulsion along the bottom or up the sides of the tank, as if pushed on by some continual pressure from behind. In a moment he mounts the perpendicular side, and through the transparent glass we have an opportunity to see how he moves. In the centre of each arm there is a depression, and in each depression there are several rows of pure white suckers, extending from the base to the tip of the arm. These are his locomotive organs, and well do they serve the purpose. There are hundreds of them, elastic yet muscular, all working at the same time to propel the creature along. One loosens its hold, stretches itself out, and takes another hold an eighth of an inch further up. Others follow, and the creature moves. It is held firmly, yet at the same time is continually moving.

But see, it is approaching a mussel hanging by its finely-woven byssus to the side of the tank. Can it have designs upon this shell-fish? Straight toward it the star moves; it nears the mussel; the forward suckers touch the shell; the star hesitates a moment, then moves on faster than before. One arm has passed over the

mussel, and the mouth of the star-fish is just over the centre of the shell. Surely it can do no harm to this well-defended shell-fish? Its mouth is so small that it cannot swallow the mussel, and surely it can't bore into the hard shell? The star-fish has stopped. The five arms are curled around the mussel, and it is held in a strong embrace. We watch the star-fish with renewed interest, but all we see is the same motionless attitude, no change in position, nothing to indicate change. The star seems satisfied to remain as it is, as if at rest. Soon a thin membrane encircles the mussel, but nothing further is seen.

We revisit the aquarium at the end of an hour, and the star is in the same position; at the end of two hours there is no change. But in three hours we return to see the star-fish nestled in the darkest corner of the aquarium, while the unfortunate mussel hangs on its old position quite dead, the shell gaping open, and numerous little shrimps feed on the half-digested parts left by the destructive star-fish. What has been done? Simply this—the star-fish, unable to take the shell into its stomach, has accommodated itself to circumstances, and extended its stomach out of its mouth, and digested the shell-fish with its stomach entirely outside of its body. In this silent manner hordes of star-fish invade the oyster-beds, and in a single night destroy thousands. The oystermen, recognising their destructive power, formerly had the stupid habit of cutting every star-fish that they caught into three pieces, and then returning them to the water, not knowing that each piece had the power of reproducing itself, and that for each star thus torn into three or four pieces, two or three new individuals were formed.—*Scientific American.*

Saccharin.

The number of valuable substances which can be extracted from coal-tar is marvellous, and would surprise gas manufacturers of a generation ago, who gladly gave away the tar to anyone who would take it. The last product of the black and ill-smelling fluid is a substance which has been named Saccharin, on account of its extreme sweetness, and the discovery is due to Professor Fahlberg. Saccharin is said to be two hundred and thirty times sweeter than the best cane-sugar. It has a great interest for the medical profession, for it can be used to render palatable the food of patients suffering from diabetes, and has been already adopted for this service in one of the Berlin hospitals. At present, the new sweetener costs forty shillings per pound. It has been ascertained by experiment that saccharin is innocuous, and we feel sure that if its price can be reduced it will become a formidable rival to sugar.—*Chambers's Journal.*

Remarkable Properties of Cork.

Mr. William Anderson lately delivered an interesting lecture before the Royal Institution "On New Applications of the Mechanical Properties of Cork to the Arts." He showed that cork was unique among solid substances in being capable of cubical compression both from forces applied in opposite directions and from pressure on all sides. This is shown when cork is immersed in water and is subjected to hydraulic pressure. The phenomenon in question is due to the peculiar cellular structure of the material, which causes it to behave more like a gas when under pressure than like a solid. Mr. Anderson proposes to use cork instead of air in the air-vessels of water-raising machinery, and he showed by experiment how well fitted it was for doing this duty. He also proposes to use it in connection with gun-carriages in the following way: the carriage is to be furnished with hydraulic compressors in the customary manner, but the water in the cylinders is to be driven by the recoil of the gun into a vessel filled with cork. This will represent a store of energy which will run the gun out again when loaded, by the aid of a tap, which will liberate the water from the compressed cork. The lecture certainly exhibited cork in a new character, and called attention to many ways in which it can be used with advantage.—*Chambers's Journal.*

Preparing Leaves to Show Starch-Grains.

The leaf, according to Professor J. Sachs, must be bleached and made transparent in this way:—The fresh leaf is placed in boiling water for ten minutes, then the Chlorophyll is extracted with Alcohol. This decolourises the leaf without rupturing the starch-cells. Treatment with iodine makes the starch visible, and the greater or less intensity of the blue colour is an apparent indication of the greater or less quantity of starch. Comparative experiments may be made by exposing part of a leaf to sunshine and protecting the other part. In the evening a leaf shows much more starch than in the morning.

Remarkable Shower of Flies.

On Saturday morning, August 7th, at Cupar, near Edinburgh, a phenomenon of an exceptional character was witnessed. About eight o'clock an immense shower of flies fell on the road near the railway-station, of a larger size than the ordinary house-fly. The road was completely covered for the distance of about 300 or 400 yards. They were dead when they fell.—*Daily Telegraph.*

A Chemical Garden.

A chemical garden is made as follows:—Place a quantity of sand in a wide-mouthed bottle (or, better, a half-gallon fish-globe) to the depth of two or three inches; in the layer of sand slightly imbed a few pieces of sulphate of copper, sulphate of aluminium, and sulphate of iron; pour over the whole a solution of silicate of soda (commercial water-glass) 1 part, and water 3 parts, care being taken not to disarrange the chemicals in pouring in the solution. Upon standing a week or so, a dense growth of the silicate of the various bases used will be seen in various colours. Now displace the silicate of soda with clear water by conveying a small stream of water through a small narrow tube (such as a nursing bottle tubing) into the vessel, which will gradually displace the silicate of soda solution. Care must be taken not to break down or disarrange the growth with the stream of water. When successful, this produces a very beautiful scene.—*Canadian Journal.*

Answers to Queries.

41.—Sections of Earthworm.—As the Editor is willing to give the space for an article on the above, will E. W. W. oblige readers by his assistance? I for one should be very glad of any information on the subject. V. A. L.

93.—Ringing Slides.—The material known as "Painters' Knotting" is simply shellac dissolved in ordinary spirits of wine, and is therefore much the same as liquid marine glue, which is used by many mounters of objects for the microscope for the purpose of preventing the coloured ringing cements from running in. The two coats Mr. Vial recommends should be as thin as possible, and only just cover the exposed edge of the Canada balsam, and one coat should be perfectly dry before the other is put on. H. W. Lett, M.A.

96.—Petroleum.—(Lat. petra, rock, and oleum, oil.) Literally "rock-oil"; a liquid mineral pitch, or bitumen, so called from its oozing out from certain strata like oil. It is usually of a dark yellowish-brown colour, more or less liquid according to external temperature, and consists of 88 carbon and 12 hydrogen. It occurs in various formations, chiefly in connection with fields of coal and lignite, and appears to arise from the decomposition or distillation of these strata by subterranean heat. Naphtha consists

of 86 carbon, 14 hydrogen, and is bitumen in its purest and most fluid state; when of the consistence of oil, it is known as petroleum (1 to 8 per cent. of nitrogen, oxygen, and ashes); in its next stage of inspissation it is called maltha, or slaggy mineral pitch; then claterite, or elastic bitumen; and ultimately it becomes indurated into asphalt, which varies considerably in purity, some specimens yielding from 8 to 14 per cent. of oxygen and nitrogen, and from 4 to 6 per cent. of inorganic ashes. V. A. L.

96.—**The Origin of Petroleum.**—The similarity existing between petroleum and the oily tar obtained by destructive distillation of organic matters, whether coal or wood, below a red heat, renders it highly probable that petroleum has been produced by the decomposition of vegetable and animal remains, and that its origin is closely connected with the formation of coal and other bituminous minerals. In any discussion as to the origin of petroleum, strict attention must be paid to the composition of the various products, which, although called by different names, may all essentially be classed as similar, if not identical, in their percentage of chemical composition. As a class, they may be termed "Bitumens," and consist of hydrocarbons, containing $C_n\ H_{2n} + 2$, commencing with gaseous products, such as marsh gas, $C\ H_4$, and terminating with solid paraffin, with various proportions of oxidised products. Solid paraffin itself contains at least three products, having melting points varying from 130° F. to 145° F., and a mean composition of $C_{27}\ H_{56}$; whilst ordinary American petroleum is a mixture of liquid hydrocarbons, having specific gravities varying from ·590 to ·880, and boiling at temperatures varying from freezing point—*i.e.*, 32° F.—to 240° F. Some of these are Cymogene, sp. gr., ·590, boils at 32° F.; Rhigolene, sp. gr., ·625, boils at 65° F.; Naphtha, sp. gr., ·700, boils at 90°; Benzine, sp. gr., ·730, boils at 120°; Kerosene, or refined petroleum, sp. gr., ·802, boils at 216°; and Paraffin oil, which has a sp. gr. of ·880, by far the largest amount being Kerosene.

Many other substances obtained from natural sources possess analogous compositions, such as Earth Oil, Mineral Naphtha, Rangoon Oil, Mineral Tar, Ozokerit, Rock Oil, Bitumen, etc. Another point to be considered is the geographical, and especially the geological, distribution of these allied substances. With respect to the former, we find one or more of these products distributed very widely over the earth, and including England, France, Germany, Galicia, Italy, Dalmatia, Wallachia, The Crimea, The Caspian Sea, Greece, Central Asia, Burmah, Trinidad, and various regions in North America. With respect to geological distribution, the occurrence of petroleum is almost as wide as is its geographical distribution. In England, France, and Germany, bituminous products are chiefly found in connection with

the carboniferous system, and generally intimately allied with coal. At Seyssel, bitumen is found in calcareous oolite. In California, Professor Silliman describes oil-tracts in cretaceous or possibly tertiary strata. In the Caspian district the oil-rocks appear to be tertiary, and the bitumens of Trinidad and Venezuela are obtained from the Miocene series of the tertiary formations. The general rule with respect to North America, however, is that oil-bearing strata are only found amongst the Palæozoic rocks seldom higher than the upper coal-measures, the strata usually being dislocated and forming an anticlinal, dipping in opposite directions, at angles varying from 30 degrees to 60 degrees, and having a probable thickness of 800 feet. The geological situation of the real oil-bearing rocks in West Virginia is most probably the Devonian strata, from which, owing to great disturbance and fissuring, the oil has every facility for flowing to the higher strata and even to the surface, this upward flow being occasioned by subterranean gaseous pressure.

This general geographical and geological distribution of the product has led many to doubt the generally received opinion that petroleum has been formed by the action of heat on coal-beds situated beneath the surface; but in reality, when we consider that coal itself has quite as wide a distribution, there appears no good reason for doubting the connection between the two. Or, rather, perhaps, we may place the matter in this light—that both coal and petroleum have been formed from organic products under the surface by the combined action of heat, water, and pressure, in some cases the bituminous matters being produced directly from organic matters and in others from coal, the product in the last case being either anthracite or some form of non-bituminous coal or graphite. The idea has been propounded that petroleum is of cosmic origin, but this theory appears to be built on the very slender data of hydrocarbons having been detected by the spectroscope in some comets.

It has also been suggested that petroleum may have been formed by the combination of carbon and hydrogen at considerable depths below the earth's surface under the influence of volcanic heat and great pressure. Thus, carbon and sulphur produce carbon disulphide, and this, heated with sulphuretted hydrogen in presence of copper, produces marsh gas, which, in several ways, may be converted into higher hydrocarbons.

Though this is not a probable process, it is given as one example of the possibility of natural inorganic products being converted by the great chemical reactions always proceeding in the earth into substances which we generally class as organic.

J. W. Gatehouse.

97.—Kerosene is one of the many names for refined paraffin oil. Benzoline is the highly volatile and inflammable spirit obtained in purifying the crude oil, and the presence of which in inferior qualities of the oil renders it so dangerous to use.

H. E. Freeman.

97.—Kerosene.—The following extract will perhaps answer S. B. as to "What is Korosene?":—"We learn from the *Oil, Paint, and Drug Reporter* that the late Dr. Abraham Genser obtained a patent on 'Kerosene Oil' in 1854. It originated from the fact that paraffin, being formerly called 'tar-wax,' it was suggested that the Greek words which signify 'wax-oil' might form a proper name; therefore, *Keros* and *elain* were consolidated to read 'Keroselain.' At that time a compound of alcohol and spirits of turpentine, known as 'camphene,' was in use as an illuminator, and it was subsequently decided to adopt its termination, and coin the word 'kerosene.' The patentee used the word to distinguish certain portions of the distillate from coal also. The word has kept itself in popular use, being applied by consumers to all kinds of mineral illuminating oils, and has passed into the language through the dictionary since it was originated thirty years ago. The first Kerosene oil distilled from coal in this country (U.S.A.) was made in 1854 on Newton Creek, Long Island. Following Kerosene came Breckenridge, paraffin, lucaseo, and carbon oils. A man named Ferris, of Tarentum, introduced the first burning oil made from petroleum, and called it 'carbon oil,' which is yet a household name in the West."—*National Druggist.*

From the above, I conclude that the "Kerosene" of the United States and the paraffin oil of England are identical, more especially as the greater portion of the "paraffin" oil sold here is imported from America.

T. A. S.

99.—Cleaning Diatoms.—The following simple process, communicated by Dr. Stolterforth to the Quekett Club (*vide Q.M.C.J.*, Vol. VI., p. 95), may be of service to A.T.:—Place in a test tube, 6 inches long by 1 inch wide, a portion of the earth or mud, about quarter of an inch in depth, and pour in water until the tube is one-fourth full. Into this drop a piece of common yellow soap, about the size of a small pea; then boil gently for an hour over a lamp. Examine the solution under the microscope from time to time by taking out a drop with a dipping tube. As soon as the valves are clean, fill up the test-tube with cold water, and let it stand; then wash in the usual way until all trace of soap is removed, and mount in any way desired. In pouring on cold water, after the boiling, the solution is quite fluid as long as the water is warm; during this time the diatoms fall to the bottom, but on cooling the solution assumes a jelly-like consistence, and

holds the fine particles and mud in suspension, easily getting rid of what is often a great trouble. In deposits in which there is so much organic matter, recourse must still be had to acids or fire to destroy this; but the result will be improved by afterwards boiling in soap and water. Fresh gatherings may be boiled in soap and water, and then burnt on platinum foil." H. E. FREEMAN.

100.—Retina.—I think "Optic" will find the first part of his question fully answered in any good work on optics.

The inverted image on the retina is easily seen in an excised eye of an albino rabbit, or in any other, by removing a portion of the sclerotic and choroid, and supplying its place with a piece of glass.

"The reason of the inverted retinal image being seen as an erect object is usually explained as a psychical act. The impulses from any point of the retina are again referred to the exterior, in the direction through the nodal point. The reference of the image to the external world happens thus—that all points appear to lie in a surface floating in front of the eye, which is called the field of vision. The field of vision is the inverted surface of the retina, projected externally; hence the field of vision appears erect again, as the inverted retinal image is again projected externally, but inverted."—*Landor's* "*Physiology*," *translated by Stirling.*

The idea has struck me that this may be more easily explained by stating that rays from an object falling upon the lens are diverted from the straight line, those from above being bent downwards, those from below upwards, thus producing an inverted image upon the retina; but at the moment these rays impinge upon the retina, they are again projected outwards, and having to pass through the lens from behind, they again diverge in the opposite direction, the lower becoming the upper and the upper the lower points, and so the object is seen in its correct position. (I have never seen this explanation given in any book.)

After extraction of the lens, as in the operation for cataract, the principal disturbing or refracting cause being removed, rays must pass in a more direct line to the retina, and I expect if the image upon the retina could be seen, it would be found to be an erect one; but as there is no lens to correctly focus the object at any point, vision is cloudy and blurred until an approach to correct sight is obtained by wearing an artificial lens in front of the eye.

That rays pass outwards from the eye can be proved in the case of *Muscæ Volitantes*, which are well known to be particles in the vitreous or in the retina, but which are seen projected forwards, highly magnified at some distance in front of the eye.

FREDK. MASON.

100.—Retina.—Many ingenious arguments have been used to explain why objects appear erect, whilst their images painted upon the retina are inverted, although a little reflection on this circumstance renders it probable that such must necessarily occur, from the law that all objects appear to be placed in the direction pursued by the rays which eventually reach the eye. (See Golding Bird, "Natural Philosophy," p. 610. London: Churchill.)

THOS. M. DOLAN.

100.—Retina.—Erect vision. The law of visible direction explains this difficulty—*i.e.*, the line of visible direction does not depend on the direction of the ray, but is always perpendicular to the retina.

"The interior of the eyeball is as nearly as possible a perfect sphere. Lines perpendicular to the surface of the retina must all pass through one point—namely, the centre of its spherical surface. This one point may be called *the centre of visible direction*, because every point of a visible object will be seen in the direction of a line drawn through this centre to the visible point. When we move the eyeball, by means of its own muscles, through its whole range of 120°, every point of an object within the area of the visible field, either of distinct or indistinct vision, remains absolutely fixed; and this arises from the immobility of the centre of visible direction, and consequently of the lines of visible direction joining that centre and every point in the visible field. Had the centre of visible direction been out of the centre of the eyeball, this perfect stability of vision could not have existed." "If we press the eye with the finger, we alter the spherical form of the surface of the retina; we consequently alter the direction of lines perpendicular to it, and also the centre where these lines meet, so that the directions of visible objects should be changed by pressure, as we find them to be." "Many philosophers have perplexed themselves in attempting to deduce erect vision from inverted images. The law of visible direction removes at once every difficulty, for as the lines of visible direction must necessarily cross each other at the centre of visible direction, those from the upper part of the image go to the lower part of the object, and hence an erect object is the necessary result of an inverted image."—*Brewster's "Optics."* H. E. FREEMAN.

100.—Retina.—That the images of objects are actually inverted on the retina may be experimentally shown by dissecting the posterior portion of the eyeball of any animal so as to lay bare the choroid. Fix now the eye in an aperture of any screen in a darkened room, and place a candle in front of the pupil at a distance of from 16 to 20 inches, when an inverted image of the candle will be seen through the choroid.

It must be remembered, in any explanation of the reason why we do not see objects inverted, that the term "inversion" is merely a relative one. If an object be inverted, it can only be so with reference to some other object or objects placed in an opposite position to itself. But with respect to the image formed on the retina of the eye, all objects, both near and remote, even every part of the observer himself, will be delineated on the eye in the same "inverted" position, so that, as far as the impression on ourselves is concerned, "inversion" has no meaning. By saying that an object is "erect," we mean that its axis points towards the centre of the earth, and as we ourselves are erect, we refer all other objects imprinted on the retina to the position we ourselves maintain. The following is from Lardner's "Optics" on the subject:—"Inversion is a relative term which it is impossible to explain, or even to conceive, without reference to something which is not inverted. If we say that an object is inverted, the phrase ceases to have meaning unless some other object or objects are implied which are erect. If all objects whatever hold the same relative position, none can properly be said to be inverted. As the world turns upon its axis once in twenty-four hours, it is certain that the position which all objects hold at any moment is inverted with respect to that which they held twelve hours before, but the objects as they are contemplated are always erect."

J. W. Gatehouse.

103.—Sharpening Knives.—It is necessary to have a good razor-strap, or a long and wide oil-stone of the finest quality. To secure a plane bevel of the cutting edge, the surface of the strap must be perfectly smooth, flat, and hard. In using the strap the knife is drawn back and forth, back foremost, without pressure, until the edge appears sharp when tested in the manner mentioned (*i.e.*, a bi-convex edge). In using an oil-stone, it is well to cover the surface of the stone with a mixture of glycerine (2 parts) and water (1 part). The blade is laid flat on the stone and pushed forward, edge foremost, in such a manner that the free end of the knife finishes by resting on the more distant end of the stone. Here the blade is turned on its back and returned, edge in advance as before, to the place of starting. In drawing the blade the utmost care should be taken never to raise in the slightest degree the back from the stone; and, further, the knife must not be pressed on the stone, but held lightly by the finger-tips, and the necessary friction be left to capillary adhesion. After drawing the knife fifteen to twenty times, it should be tested as before (C.O.Whitman's method). V. A. L.

104.—Bleaching Bones.—I can recommend the following as a simple and effective method, and it gives them the appearance of

ivory:—After digesting the bones with Ether or Benzine to recover the fat, they are thoroughly dried and immersed in a solution of Phosphoric Acid, containing 1 per cent. Phosphoric Anhydride ($P_2 O_5$). I remove them after a few hours from the solution, and well wash in water and then dry them.

V. A. LATHAM, F.M.S.

104.—Bleaching Bones.—A similar question to yours was asked in the *Scientific American* a short time ago. The question said, "I have a complete human skeleton just from the chaldron of a medical college which I desire to bleach. To 4 gallons of water I added half a pound of chloride of lime and half a pound of washing soda—the latter to cut the grease and give the chlorine a chance. I kept the bones in this solution four days, but the results are not satisfactory. What can I do without resorting to the slow process of rain and sunlight?" The editor in reply says, "Your error is in thinking that the work can be done speedily. It is impossible to extract the oily matter from the bones except by a very slow process. Boiling in any amount of alkali—say, your washing soda—will not accomplish it, and all the oil must be absolutely removed before you can do anything toward the bleaching. Very long maceration in water alone, or in soda and water, will effectually effect it, but a much better material is benzine. Make a tin box in which you can pack your skeleton, solder on the cover, leaving only the round hole for filling. Pour in benzine till your box is filled, stop the hole securely, and leave it undisturbed for three months. Your skeleton will come out clean, and can be bleached perfectly by sunlight. Chlorine will do the bleaching quicker, but it injures the bones. Never use it. Any shorter process will give you a skeleton which will always be nasty."

I think C. D. will find this a thorough and satisfactory reply.

W. S. A.

The following Questions which have appeared in our earlier numbers still remain unanswered. We shall be glad if our friends will try to reply to them.

No. I.

5.—Hairs of the Mole.
8.—Mites found on Æcidium.
10.—Weevils.
14.—Stratena.
21.—Pine Woods *v.* Raspberry Canes

No. II.

23.—Landscape Photography.
27.—Chloride or Gold and Aniline Stains.
31.—Blood Corpuscles.
33.—Bromine.
35.—Parasitism among Marine Animals.

No. III.

43.—Dendritic Crystals.

Queries.

109.—Pictures of Leaves.—I have seen pictures of leaves which show white on a dark ground, and shall be glad to know how they are produced. Is it by some photographic process? B.

110.—Preserving Spiders.—Can anyone give me the most approved methods of preserving spiders, to show all the mouth-organs, eyes, spinnerets, etc.? V. A. L.

111.—Hedgehog.—Can anyone suggest an explanation of the alleged fact that hedgehogs are proof against the effects of the most virulent poisons (strychnine, arsenic, prussic acid)? How can the phenomenon be physiologically accounted for? V. A. L.

112.—Helix Cantiana.—A friend informs me that he has seen black ants feeding on *H. Cantiana*. Could ants be made useful in clearing small shells of the animal? H. H. L.

113.—Iodine in Sea-Air.—Could you direct me to any papers, proving that iodine was found in sea-air? I am aware that ozone is found. Sea-Weed.

114.—Mounting Chitine.—Can any reader inform me by what process I can render thin sections of chitine transparent, and what is the best medium to mount them in? B. H.

115.—Preserving Cartilage.—Can you, or any of your readers, inform me of a way of preserving cartilage in its natural shape without permanent immersion in fluid? H. H. L.

116.—Preserving Zoophytes.—Can any reader inform me what is the best way to prepare and mount Zoophytes for the microscope? I have a number of dried specimens, and find great difficulty to spread the tentacles out so as to observe structure. Which is the most instructive way—to mount them in balsam or dry and opaque? H. A. S.

117.—Spots on Sycamore Leaves.—I shall be glad if any readers could tell me the cause of the black spots which appear on the leaves of the sycamore in the summer. Do similar spots appear on the leaves of any other trees? W. B. D.

118.—Carbolic Acid and Cement.—Can anyone oblige by saying what cement will not be dissolved by carbolic acid when forming the medium for mounting insects? Carbolic acid acts upon chitine in an extraordinary manner, showing a kind of imbrication on one side (of some insects, notably parasites) and reticulation on the other. The insect, when treated with oil of cloves or aniseed, after the carbolic acid, loses its interesting appearance, and the imbricated character is almost destroyed. Again, if treated with glycerine after carbolic acid, the change is greater still. Will someone try to enlighten? V. A. Latham.

119.—Ringing Slides.—Would any reader give any information as to ringing slides? As a beginner, I have mounted some specimens—such as heads of insects—in spirit, and some large dry mounts enclosed in zinc rings, with the cover-glass placed over; a ring of brown cement overlaps a little of the cover-glass and ring. What I want to know is how to fill up the space and hide the ring, like the specimens shown at opticians. As the ring of cement, zinc white, is run round, it spreads, instead of making a neat and high ring. Should the brush be *well filled* with cement? also, whether a *large* brush should be used, and what kind (sable, etc.?) H. A. S.

120.—Name of Bed-Bug.—Can any reader kindly explain the following?—In Lankester's "Half-Hours with the Microscope," the scientific name of the common Bed-Bug is given as *Cimex lectularius*, whilst in Cook's "One Thousand Objects of the Microscope" it appears as *Acanthia lectularius.* Sicnar.

121.—Grubs in H. Caperata.—Whilst cleaning the above, obtained to-day, I found several large white grubs, and wherever these grubs occurred the snail was partially eaten. I should say about 50 per cent. of the shell contained these unwelcome intruders. Will some reader tell me what they are? I presume the larvæ of some fly. H. H. L.

Assisting Naturalists.

THOS. BROWN, Jun., B.Sc., 23 Hyde Park Road, Plymouth.
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V. A. LATHAM, 70 Portsmouth St., Oxford Road, Manchester.
Subjects—Biology, Botany, Histology, Microscopy, Pathology.

F. N. PIERCE, 143 Smithdown Lane, Liverpool.
Subject—Lepidoptera.

Answers to Correspondents.

A. E.—We are sorry that your very interesting paper and queries reached us too late for insertion this time. Many thanks for your kind remarks.

F. W. STEELE.—We are exceedingly pleased with your two lectures on Chemistry; at present, however, we are quite unable to find room for them, but as soon as we can increase the number of our pages, we hope to add a "Youth's Corner," to which we feel sure you will be a frequent contributor.

JUNIOR.—The best work which we have seen on Stamp Collecting is Dr. Gray's Illustrated Catalogue of Postage Stamps; it is a bound volume of 524 pages, and was published by Alfred Smith & Co., Bath, about 10 years ago, so that of course it gives no information as to the newer issues, but as far as it goes it treats the subject very thoroughly. The price if we recollect right was about 5s.

The following communications are unavoidably deferred to our next. A. W. Griffin, A. E., H. W. Case., R. Gillo, V. A. L., M. A. H., S. T., T. A., W. H. S., etc. etc.

We have received the first part of the fourth vol. of *Studies in Microscopical Science*, edited by Arthur C. Cole, F.R.M.S. The subjects treated in the four sections are:—I., Botanical Histology: subject, Vegetable Physiology, represented by a section through the Apex of the Stem of Fig. II., Animal Histology: subject, The Mammalian Testis. III., Pathological Histology: subject, The Normal Kidney. IV., Popular Histology: subject, The Sea Fans. The new volume promises to be in all respects as successful as that lately completed. The slides are by A. C. Cole, and are fully up to the mark. Students in any of these branches will do well to send in their names to the Publishers, Messrs. Hammond & Co., 136, Edmund Street, Birmingham, if they have not already done so.

Sale and Exchange Column.

Worked Flints, Paleolithic and Neolithic, in exchange for Fossils.—Apply to J. French, Felstead, Essex.

Microscopical Slide Labels for Animal and Vegetable Kingdom, toned paper, 6d. per 100; samples of 33 kinds, 2d.—Chas. Watkins.

Insects in Spirit and Dry, selected for Mounting. New List ready.—Chas. Watkins, King's Mill House, Painswick, Gloucestershire.

Fish Skins.—Send stamped addressed evelope for a specimen of the Skin of the Spotted Dog Fish, cleaned and ready for mounting dry, to H. E. Hurrell, 1, Church Plain, Great Yarmouth.

High-class Injections from Monkey, consisting of lip, tongue, liver, lung, spleen, finger. The six slides for 5s.—Henry Vial, Crediton, Devon.

Microscopy.—First-class Slides of Whole Insects, 1s. each; 10s. doz. free. Satisfaction guaranteed, or money returned.—W. S. Anderson, Ilkeston.

The Scientific Enquirer.

OCTOBER, 1886.

The Study of a Few Common Plants.*

BY GEORGE L. GOODALE.

V.—SOME OF THE RELATIONS OF PLANTS TO THE SOIL.

WHEN the trunk of a tree or the stem of an herbaceous plant is carefully burned in the open air, there remains behind a certain amount of rusty-grey ashes. This substance represents the mineral matters taken in solution by the roots, and now changed somewhat by combustion. Some plants contain more of this mineral matter than do others, but all of them have a trace; and there is a substantial agreement in the chemical elements of the ash of different plants. Some of the elements which have been detected in the ash are Iron, Potassium, Calcium, Magnesium, Phosphorus, and Sulphur. These exist in composition in the ash. For instance, in the Potassium is there a carbonate; but as to the manner in which they existed in the plant, and how they were there compounded, authors are not exactly agreed. Nor is it precisely known what part each plays in the life and health of the plant. There is good reason for believing that Iron is indispensable to the efficiency of chlorophyll, and that the salts of Potassium have much to do with the production of starch. Besides the substances just mentioned, some compound of Nitrogen is essential to the growth of plants; and this is furnished likewise through the roots. If, therefore, it is desired to have plants grow in a healthy and vigorous manner, they must not only be placed under the requisite physical conditions, but good food in proper amount must be furnished.

Plants, as we have already seen, obtain their carbon from the carbonic acid of the atmosphere. The soil furnishes other kinds of matter used as plant-food. Although the germinating seeds can thrive in sand for a while, it is because they can use the good store

*From "Guides for Science Teaching."

of food laid up for them by the plant, on which they ripened. And even after this store is gone, they will do pretty well for a time; but sooner or later they need something better than sand to live in. Now sand is a very good mechanical support for sprouting seeds, if the seedlings are to be studied; for it is the most cleanly. But if the plants are to be raised from seed for the purpose of studying them in all their stages of growth, it will be better to procure some good soil at a florist's greenhouse. Flower-pots six or eight inches in diameter are large enough for the cultivation of such plants as are adapted to special study. In flower-pots of this size, it is perfectly easy, for instance, to raise good plants of Major Convolvulus to exhibit the twining movements of stems, and Sensitive Plant to demonstrate the "sleep," "waking," and sensitiveness. The plants may not prove to be so symmetrical as those raised by an accomplished florist; but they will answer a good purpose, for they are plants which the student has watched from the beginning of the growth. To show how small a part is taken in certain cases by the mineral constituents of plant-food, it may be well to call to mind one of the earliest experiments upon the subject of vegetable nutrition.* Van Helmont placed in a proper receptacle exactly two hundred pounds of carefully dried soil, and then planted therein a willow, which weighed just five pounds. The soil was enclosed by a cover so that no dust from outside could reach it; and it was kept moist with enough water as occasion required, for five years. At the end of that time, the willow was removed, and the soil separated carefully from the roots. The willow weighed then one hundred and sixty-four pounds; but the soil, again thoroughly dried, as at first, had lost only two ounces! Although the experiment was not conducted with the exactness which characterises modern research, it was a very excellent one for the time in which it was performed. It must be added that Van Helmont erroneously concluded that the plant had taken all its nourishment from the water, whereas we know to-day that the plant obtains from the atmosphere a large part of the material out of which its structure is made. Before entering upon the use of plant-food in building, it is best to glance at the different ways in which a part of the elaborated substances are held in reserve.

VI.—Food Held in Reserve.

We may speak of the carbon-dioxide taken from the atmosphere, the water from the soil, and the mineral matters therefrom obtained, as the food of the plant; but it is better on all accounts to speak of the first elaborated matter formed in the foliage under

* From page 493 of "Geschichte der Botanik," by Professor Sachs. The experiment was made about 300 years ago.

conditions now described as the proper food for the nutrition of the plant. Some plants are like spendthrifts. They use up all this food as fast as it is made, and do not lay up much or even any of it. The annual plants treasure up a little of this food in the seeds; but plants which are to live through more than one year keep more or less food in reserve in some safe place.

The food may be stored up as starch, as in most of the thickened fleshy roots and underground stems or branches, or in stems above ground, or even in leaves. The starch is packed away in the form of an impalpable powder consisting of granules of such characteristic form that its source can be easily identified by the microscope. Sago and tapioca are starches which have been carefully separated from the substance of the plants which produced them, and the former has become somewhat changed by the process of manufacture. The laundry starches are largely from potato, or from wheat. Starch in woody stems like that of the maple in early winter is lodged in the less dense part, and here it is ready to be changed into syrup at the coming of spring. Starch can be very readily detected by the blue colour which it gives when brought in contact with a dilute solution of iodine.

Another less usual form in which food is stored in reserve is sugar. This is its form in the stem of sugar-cane, and in the fleshy root of the sugar-beet. When sugar is properly made from these two sources, it is impossible to distinguish between them. Of the forms of sugar other than cane sugar, as it is called, nothing can now be said further than to point out their occurrence in fruits and exceptionally in stems. There are still other forms in which food is packed away in plants ready for use; but their consideration would not be desirable in this short series of papers. It is enough to note now that the reserve material is packed safely, and when wanted it is within reach. And next it must be seen how it is used in building, or in growth.

Short Papers and Notes.

Frog Development.

HAVING secured a large portion of frog-spawn this spring from a neighbouring pond, I placed it in a tank of fresh water to watch its development. The spawn resembles a mass of clear jelly-like eggs, adhering together, and each about the size of a pea. In each sphere of jelly is a black spot, which is the germ, and in a short time the young were hatched, breaking their way through the

egg, and were launched into their watery home as tadpoles. At this stage of their existence, as they are meant to live an aquatic life, they are furnished with a breathing apparatus, formed on the same principle as the gills of a fish, being visible on the outside like a tuft of long-shaped appendages at each side of the head.

As my tadpoles were out of their usual *habitat* of a pond—where naturally there is plenty of food for them—I fed them on tiny shreds of raw meat once or twice a week. They are very voracious, and feeding greatly assists in their development. No sooner did their gill-like appendages reach their full size than they began to diminish again, the shape of the body and head being at the same time greatly altered. In a short time the gills entirely disappeared, being drawn into the cavity of the chest. Next appeared two little projections just behind the head, which soon developed into legs. The tadpole, however, does not use them yet for progression, as it only moves through the water by the quick undulations of its tail. Soon another pair of legs made their appearance in front; the tail was gradually absorbed into the body, and internally the lungs were then fully formed. They now eagerly sought for a resting-place on land, where they could breathe atmospheric air, and leap about as veritable little frogs about half-an-inch in size. Tadpoles are very hardy, and it was a most amusing sight to see them feed. About eight or ten of them would congregate round a morsel of meat, grabbing it in their mouths, and tugging as hard as they could, till they had entirely absorbed all its juices. Their development with me took about two months, but it is quicker when they are not in captivity.

MINNIE MCKEAN.

On Mounting Certain Diatoms.

THERE is a fine art in mounting microscopic objects, that many of the more stolid investigators affect to despise; but so long as the specimens are not distorted, misshapen, or crushed out of their natural condition, they lose nothing for purposes of study, by being skilfully prepared for exhibition, and there is no doubt, the more perfectly the minute perfections of microscopic shell carapaces and other organic structures are revealed by our art, the more attractive does our science become. One may be very wise and familiar with details of microscopic structure through long studies from the strictly scientific side, and yet oblivious to the beauty and wonder which would inspire another not less learned. The difference is surely in favour of those who most keenly appreciate the æsthetic in their work, for from that arises an inspiration which elevates and

broadens our thought, and is an incentive to further study and search for the sources and relation not only of the organisms themselves, but also of their microscopic carvings and elaborate ornamentation. Have we any reason to suppose that the markings on the shell of a diatom are merely for beauty—to please the eye and arouse the wonder of the microscopist? Be assured there is a deeper reason for them, perhaps purely utilitarian, if only to combine strength with lightness; perhaps they are a manifestation of that tendency observed throughout organic nature which some one has characterised as "a kind of organic crystallisation"—an expression which implies symmetry and beauty of form, while it does not conceal the want of knowledge that underlies it.

The usual method of mounting *Isthmia* is by drying the frustules, either on the seaweed, or, freed by shaking, on an opaque ground. In this way, by exercising some care in selecting the most showy groups, very attractive specimens may be obtained. A dry mount of the free frustules can be greatly improved by previously clearing them, or rather removing the dried endochrome. The best way to do this is to place them for a few minutes in a bleaching solution, which may be chlorine water, Labarraque solution, or any such active agent. No acid is required. In the course of fifteen minutes the frustules will probably be quite white, and, owing to the air contained in them, they will form a perfectly pure layer floating at the top of the fluid. It is then only necessary to remove the solution below by means of a pipette or syphon, wash several times with water, drawing it off in the same way, and finally collecting the diatoms in a bottle with some alcohol for preservation. They are now perfectly clean, and white as snow.

To prepare a dry mount, select a clean cover-glass, and upon it place a sufficient number of the cleaned diatoms with water to form a perfectly even layer of the diatoms over the central part of the cover. As the water evaporates, the frustules will gather close together and form a compact mass in a single, uniform layer, perfectly adapted for a display slide. An exceedingly thin and clear solution of gum may be used in this operation to attach the frustules more securely. When thoroughly dry cement the cover-glass over a ring just deep enough to protect the diatoms, preferably with a dead-black bottom.

This particular diatom, however, is a far more brilliant object when mounted in balsam and viewed with a dark field. It is likewise one of the most difficult to mount in balsam, owing to the persistence with which the air is retained within the frustules. A mount in balsam of the diatoms attached to the seaweed as they grow can be made by the method devised by the late Charles Stodder. Selecting a perfectly dry specimen, place it in chloroform for a short time, and, if necessary, in order to remove all the air,

heat the latter gently. In this way the frustules become filled with the liquid. Then place some drops of chloroform on a slide, transfer the specimen selected for mounting to this, and keep it covered with the liquid. It is well to put on a cover-glass to prevent rapid evaporation of the liquid. Then add chloroform balsam, and let it run under the cover and follow the chloroform as it evaporates from the frustules, aiding the operation with gentle heat. In this way the hollow frustules can be completely filled with balsam without difficulty, and the mounts thus obtained are very fine.

In mounting the free frustules in balsam we have adopted a plan somewhat different in detail, in order to obtain a perfectly flat and even layer of frustules against the cover-glass. The cleaned specimens in considerable abundance were first placed in chloroform in a small vial, and raw, hard balsam added until a not very thick solution was obtained, which thoroughly permeated the shells. The solution was poured upon a cover-glass resting on a mounting table with a spirit-lamp beneath. In a short time the frustules settled down upon the cover-glass and formed an even layer. The closer they are the more effective the result. Heating now, very gently indeed, the balsam becomes slowly hardened without disturbing the diatoms. If necessary, more balsam can be added, but if possible a sufficient quantity should be put on at first, as the addition of more is likely to disarrange the specimens. The balsam must be thoroughly hardened, without heating sufficiently to discolour it. We now have the frustules nicely mounted in balsam on the cover-glass, and the latter may now be turned over and attached to a ring on a slide, and the mount thus finished. It will be greatly improved, however, by the well-known process of backing with black varnish. First put on a layer of shellac over the balsam to protect it from the action of turpentine, and then apply an opaque layer of black varnish. When this is thoroughly dry, mount the cover-glass on a ring, and it will make one of the finest objects in any cabinet.—*Am. Mon. Micro. Journal.*

Spider's Web.

For a long time, in fact until comparatively quite recently, it was unknown how the long threads of spider's web, which thickly cover the hedges and grass at certain seasons of the year, were formed. It is a most interesting experiment to see for one's self how these mysterious threads, as they used to be considered, are produced; the way is to find a spider, not a hunting, nor a death-feigning spider, as these will not perform well, but any other common spider will do, the larger the better, as the thread is more

easily seen. Put a stick upright in a plate of water (a knitting needle stuck upright in the cork of a bottle does very well), and put the spider on the stick: she will stay perfectly quiet so long as the air is still, but put your apparatus in a draught and you will see a pretty sight; the spider will travel up and down perhaps until she reaches the water, and, finding no escape this way, will put her spinnerets up into the air, and immediately emit a long silky thread, which the draught will carry to a distance of many feet. After the spider has sent out as much as she thinks sufficient to reach some neighbouring object (your face if you are incautious enough to get in a straight line to leeward) she will begin to haul in the slack; if the web has failed to reach anything she will haul it all into a ball at her feet, and try again; if it has reached anything the web sticks firmly to it by its own adhesiveness, and when the spider has hauled it tight, she travels along it, and escapes from her prison. The web is emitted as a fluid, which hardens instantly on coming in contact with the air; when the air is still the spider knows that it is useless to send out a web, but directly she feels the draught she knows that her web will be carried out for her into as long a line as she likes.

The curious phenomenon of the gossamer threads is to be explained in this way: On hot days, when a strong current of heated air rises from the earth, the gossamer spider, seized with a desire for seeing a little more of the world, or for some other reason known only to itself, emits a long thread which is carried many feet up into the air. The spider then quits its hold and travels far aloft; when night comes, and the air gets cold, the upward currents of air have ceased, and the web falls, sometimes to be seen like threads of silver on the grass in the early morning, sometimes in white flocculent masses of threads tangled with the wind.

Anyone interested in collecting spiders will find an excellent "artificial fly" in a *tuning fork*; it is amusing to see the fury with which a large and hungry garden spider will rush at the vibrating fork, and spin a web round the, I fear, highly indigestible end of it. Many kinds of spider, if hungry, may be induced with it to come out of their lairs.

A. East.

A Cheap and Effective Substitute for a Killing-Bottle for Insects.

Get a small round tin canister, about 1½ inch in diameter and 3 inches deep, by preference, place in the bottom some bits of sponge moistened with benzoline; upon this place a cork which fits the inside of the canister. This cork to be about half-inch deep, and perforated with small holes, and having two holes through which a

piece of thick string with knots, is passed so as not to allow it to come through, but forming a loop on the top side, so that the cork can be pulled out. Close the mouth of the canister with a good large cork instead of the tin cover. R. GILLO.

The King of Spiders.

A French entomologist has described the bird-spider of tropical America, the largest of the several hundred known species of spiders, as a formidable creature having a body four and a quarter inches long, or a diameter of seven inches with the legs extended. Its nest, in the centre of which its 1,500 or 2,000 eggs are deposited, is so strengthened as to be capable of arresting a small bird ; and the spider is sufficiently powerful to destroy not only young birds and adult humming birds, but large lizards and reptiles.

To Obtain Transfers from Prints, etc.

Place the engraving for a few seconds over the vapour of iodine ; dip a slip of white paper in a weak solution of starch, and when dry in a weak solution of oil of vitriol. When again dry, lay a slip upon the engraving, and place both for a few minutes under a press. The engraving will be reproduced in all its delicacy and finish. Lithographs and printed matter cannot be transferred with equal success.—*Scientific American.*

The Breeze or Gad Fly.

The naturalist who may, in the pursuit of his delightful study, be walking in the pastures on a warm day in that most pleasant part of the year when leafy summer is verging on the sere and yellow of autumn, be sometimes greatly startled by a sudden stampede of the herd which had been quietly browsing, who, with tails elongated, and head and neck stretched out, and countenance betraying affright, make for some pool or stream of water.

The formidable enemy that causes this alarm, and seems to inflict so much torture, is the *Œstrus Bovis*, the Breeze or Gad Fly, which at this time is seeking a habitation for its future young, and selects the hide of cattle for this purpose. It is said to choose the younger beasts, and those that are in highest condition. There has evidently been considerable exercise of selection ; for a great many of the cattle in the same pasture will have only a few warbles on their backs, while others will, in a manner, be covered by them.

The *Œstrus Bovis* is the largest and most beautiful of this genus. Its head is white, and covered with soft down ; its thorax

yellow anteriorly, with four black longitudinal lines; the centre of the thorax is black, and the posterior part of an ashen colour; the abdomen is also of an ashen colour; with a wide black band in the centre, and covered posteriorly with yellow hair. It does not leave its chrysalis state until late in the summer, and is then eagerly employed in providing a habitation for its future progeny. It selects the back of the ox, at no great distance from the spine on either side, and alighting there it speedily pierces the integument,* deposits an egg in the cellular substance beneath it, and probably a small quantity of some acid, which speedily produces a little tumour on the part, and accounts for the apparent suffering of the animal.

The egg seems to be hatched before the wound is closed, and the larva, or maggot, occupies a small cyst, or cell, beneath it; the tail of the larva projects into this opening, and the insect is thus supplied with air, the principal air vessels being placed posteriorly; while with the mouth, deep at the bottom of the abscess, it receives the pus, or other matter that is secreted there.

A fluid, resembling pus, can always be squeezed from the tumour, and increasing in quantity as the animal approaches its change of form. In its early stage of existence the larva is white, like that of most other flies; but as it approaches its maturity it becomes darker, and at length almost black. These little tumours form the residence of the larva, and are recognised by the name of warbles.

The abscess having been once formed appears to be of little or no inconvenience to the beast on whose back it is found. It certainly does not interfere with his condition, and the butcher regards the existence of these warbles even as a proof of a disposition to thrive. The injury to the skin, however, is another affair, and the tanner would probably tell a different story. The larva, if undisturbed, continues in this cyst until the month of June or July in the following year, and then forces itself through the aperture already described, the accomplishment of which occupies two days.

It is soft when it first escapes, but it soon hardens; and if it is

* The weapon by means of which the perforation is effected is a very singular one.

It seems to be formed of three different pieces, enclosed the one within another like the divisions of a telescope, and from the farthest and smallest the true augur for perforation, proceeds.

In 1823 and 1824, however, the *æstræ* were so numerous in the department of Soiret, in France, and the tumours accumulated to such extent on the cattle that they occasioned fever, inflammation, and death. There was a disposition to inflammatory fever prevailing at the same time amongst most species of domesticated animals.—"Rapport à la Société Royale et Centrale d'Agriculture, 1826."

fortunate enough to escape the birds, which are on the look-out for it, or if it does not fall into the water, which the cattle seem now instinctively to seek, as it were, to destroy as many of their enemies as possible. It conceals itself in the nearest hiding-place it can find, where it remains motionless until it changes to a chrysalis, which is speedily effected; it continues in its new form about six weeks, and then bursts from its shell a perfect fly.

It is a very singular circumstance, that the escape of the larva from its prison on the back of the ox always takes place in the morning, and between six and eight o'clock.

Is the mysterious principle of instinct already at work? Does the maggot know, that if it forced itself through the hole in the warble at a later period, the heat of the sun would destroy it, or that if it fell during the night, it would perish before it could reach a place of refuge?

Being also exposed to many dangers in its chrysalis state, it is covered with a scaly coat of great strength, and from which it would seem impossible for it ever to make its escape; but when its change is complete, and it begins to struggle within its prison, a valve at one end of its narrow house, and fastened only by a slight filament, flies open, and the insect wings its way, first to find its mate, and then to deposit its eggs on the cattle in the nearest pastures.

Some farmers are very careless about the existence of these warbles; others very properly endeavour to destroy the grub that inhabits them. This is effected in various ways. A little corrosive liquor is poured into the hole, or a red-hot needle introduced, or the larva is crushed, or forced out by pressure with the finger and thumb.

Although the existence of the warble is a kind of proof of the health and condition of the animal, yet there is no reason why the best beasts should be tormented by the gad fly, or the strongest and best hides be perforated, and, in a manner, spoiled in their best parts. Although when the larva escapes, or is expelled, the tumour soon subsides, the holes made are scarcely filled up during that season, and even a twelvemonth afterwards a weakness of the hide, and disposition to crack will show where the bot has been.

This paper is compiled from the works of Mr Bracey Clark and Mr W. Youatt, the celebrated veterinarians, and that particularly excellent French entomologist, M. Reaumur.

H. W. C., Cotham.

Insect-Killing Bottles.

The public danger arising from the sale of insect-killing bottles containing cyanide of potassium by naturalists and other persons

not registered as chemists and druggists, and without compliance with other provisions of the Pharmacy Act, 1868, has recently been brought under the notice of the Council of the Pharmaceutical Society of Great Britain, and they call the immediate attention of such persons to the fact that the sale of these insect-killing bottles by them is contrary to the provisions of the above-mentioned Act of Parliament, and that the penalty to which they render themselves liable is £5 for every sale.—The *Daily News*, August 2nd, 1886.

The use of killing-bottles containing cyanide of potassium may be entirely dispensed with by placing in a wide-mouthed bottle a piece of sponge, or some bits of rag moistened with common benzoline, which should be covered with a piece of perforated card, some brown paper, or smaller arrangement, so as to prevent the insects getting amongst the benzoline, particularly if they are lepidoptera. R. GILLO.

Answers to Queries.

43.—Dendritic Crystals.—An account of the dendritic crystals on paper will be found in Vol. I., p. 150, of the *Journal of Microscopy and Natural Science*; and in *Science Gossip*, Vol V., p. 80, there is a paper on the subject by Dr. M. C. Cooke, illustrated by a figure of one of these crystals. H. W. LETT, M.A.

58.—Stone Implements.—The best mode to number these is to paint, with a fine pencil and flake white, a small number on one corner of the stone implement. This makes a permanent reference to a list in which they can be named by comparison with the collection in some museum; and the localities where they were found should be carefully noted. H. W. LETT, M.A.

73.—Poisons of Fungi—Atropin an Antidote.—The most extraordinary action of poisons of mushrooms is upon the heart. The active principle of the *Agaricus Muscarius* has been separated by Professor Schmiedeberg, of Strasburg, and named by him *Muscarin.* The merest trace of this alkaloid will arrest the pulsations of the frog's heart almost instantaneously, and prevent its ever beating again unless its effect is counteracted. But if a minute quantity of Atropin be brought into contact with the organ, it will pulsate again, and will go on beating for a long time. For a full history of Muscarin, its action, production, etc., refer to Dr. Lander Brunton's work, "On Disorders of Digestion," which contains a large amount of information upon subjects only remotely or indirectly connected with the topics indicated by its title.

It is matter of experience that the common edible fungi acquire poisonous properties from the local conditions under which they have been developed. The writer found that mushrooms gathered under a certain holly tree produced sickness and griping, while those gathered in the open, in the same meadow, were eaten with impunity. This did not seem to be a mere coincidence, since the observation was repeated more than once.

W. B. K.

83.—Cyclops.—Transfer to filtered water for 24 hours, then substitute a few drops of spirits of wine for the water. Mix equal proportions of the medium used (Farrant's is recommended) and water, allow the Cyclops to saturate, then mount in the medium in cells.

H. P. F. G.

86.—Microscope in Class Demonstration.—If the tables in F. W. B.'s class-room be so arranged that a side-light is obtainable, a very simple method for passing microscopes is to mount them on boards running on four little wheels, which have "rubber tires." They run most easily, and with a good side-light there would practically be no re-adjustment of the mirror required.

A. W. L.

88.—Sting of Bee.—The sting of bee or wasp that is intended to be mounted as a microscopical slide should be dissected, and the sheaths set open to expose the dart, while the insect is freshly killed. By causing a bee to drive its sting into a piece of soft indian-rubber, and allowing it to struggle by itself till it parts with its weapon, is an excellent method of getting the sting out of the sheaths. Or, in the absence of caoutchouc, the bee can be made to sting one's hand, when, as before, the sting is left in the wound, the barbs on it preventing the bee from withdrawing it. The sting is then cleansed in the usual way with potash, and mounted in Canada balsam. If the bee has got hardened in the spirits in which F. W. Steel has kept it—a very likely consequence—I fear it will be too tough a job for a proper mount, unless boiling in water—which I have never tried—might soften the chitine and muscles.

H. W. Lett, M.A.

90.—Foul Brood in Bees.—I have never experienced this disease in my apiary, but I believe salicylic acid fumes cure it. H. H. W. should obtain "Foul Brood (not micrococcus but bacillus): the Means of its Propagation, and the Method of its Cure," by F. Cheshire (British Bee Keepers' Association). *Bacillus Alsei* is vegetable, a *Thallophyte*, class *Protophyta*, order *Schizomycetes*.

H. Purefoy FitzGerald.

90.—"Bacillus Alsei."—This is a vegetable, one of the very minute fungi. As I am a bee-keeper—and a pretty successful one —of many years' standing, I may mention that the only cure I believe in, and use among my friends, for "foul brood" is fire. It clears the bee-yard without permitting the other stocks to experiment on the perpetuation of the plague. Happily I know little or nothing of it among my own bees. H. W. LETT, M.A.

92.—Bumble Bees and Moss.—May it not be that these bees are in search of a suitable place to dig out for their nests? It is known that they often make their nests in the earth. I have noticed them acting as if they were exploring the character of the ground with this view. W. B. K.

95.—The Bot Fly.—I should like to add a few further particulars with respect to this insect. There are several plain conclusions from this history. The Bots cannot, while they inhabit the stomach of the horse, give the animal any pain, for they are fastened on the cuticular and insensible coat. They cannot stimulate the stomach, and increase its digestive power, for they are not on the digestive portion of the stomach. They cannot, by their roughness, assist the trituration, or rubbing-down of the food, for no such office is performed in that part of the stomach —the food is softened, not rubbed down. They cannot be injurious to the horse, for he enjoys the most perfect health when the cuticular part of his stomach is filled with them, and their presence is not even suspected until they appear at the anus. They cannot be removed by medicine, because they are not in that part of the stomach to which medicine is usually conveyed; and if they were, their mouths are too deeply buried in the mucus for any medicine that can safely be administered to affect them; and, last of all, in due course of time, they detach themselves and come away. Therefore, the wise man will leave them to themselves, or content himself with picking them off when they collect under the tail and annoy the animal. H. W. CASE.

99.—Diatoms.—If A. T. will use small crystals of nitrate of potash after boiling the diatomaceous earth in pure sulphuric acid, adding them gradually, he will find the carbonaceous matter perfectly bleached. A. W. GRIFFIN.

105.—Saccharin.—This new principle from coal-tar can be obtained from Messrs. Southall and Co., chemists, Birmingham, and the price is about 12s. the ounce. A. W. GRIFFIN.

109.—Pictures of Leaves.—This query is rather vague, since we are not told whether it is a regular *picture* of the leaf, or simply an outline in white on a dark ground. If the latter, and no detail is desired inside the border, but the whole leaf is to be white, it

is probably done by printing from the leaf on a piece of sensitised paper, thus :—Take a piece of glass and arrange the leaves face downwards as you want them to be. Put a piece of photographic printing paper at the back, a piece of cardboard over this, and fasten them together with clips. Expose the whole to daylight, with the glass towards the window, till the paper turns very dark brown, and the parts protected by the leaves stand out white. The print must be afterwards "fixed"—*i.e.*, soaked first in water, and then in a solution of hyposulphite of soda (hypo : 2½ oz., water one pint) for a quarter of an hour. After this it must be soaked all night in water, and the tap must be turned on over it for about half-an-hour. If this is not done, it will fade. Then dry it by dabbing it with a cloth first, and put bricks at the corners to prevent its curling up while drying. Those you saw might have been "toned," but I should think it is not likely. R. A. R. BENNETT.

111.—Hedgehogs (Resist Poison ?)—V. A. L. asks if anyone can suggest an explanation of the alleged fact that hedgehogs are proof against the effects of the most virulent poisons. Permit me to answer this query by putting another. On whose authority is the "alleged fact" stated? It might be as well to establish the fact before seeking its explanation, or it might turn out that we are seeking a "mare's nest." W. B. K.

111.—Hedgehogs.—Until it has been proved by actual experiment that hedgehogs are proof against the most virulent poisons, it can scarcely be termed a "phenomenon." For my part, as soon as I can capture a hedgehog—and I hear some have been seen in one of my fields—I shall try the effects of strychnine, arsenic, and cyanide of potassium. I have always looked upon the notion as ridiculous that such a creature was invulnerable by poisons that kill everything else. In *Science Gossip*, Vol. II., 1866, p. 165, is an account of a trial to poison a hedgehog by a writer who signed "P."—"I was induced, after having destroyed some mice with Battle's vermin killer, to feed the hedgehog with one of the mice so poisoned. The effect was almost instantaneously fatal to our erinaceous friend, whose brief span abruptly terminated on the spot leaving pendant from his mouth the tail of the poisoned mouse."
H. W. LETT, M.A.

112.—Helix Cantiana.—I frequently place snail shells in ants' nests for the purpose of cleansing them. These insects soon clear away any animal remains. H. PUREFOY FITZGERALD.

113.—Iodine in Sea Air.—The present communication is not a direct reply to "Sea-Weed," but failing that, it may perhaps not be without interest to your readers.

At a village on the coast of Devonshire, I have made experiments to endeavour to detect the presence of iodine in the sea-air. I put a mixture of white starch, glycerine, and water on twelve microscope glass slides, and exposed them for several days to the sea air. I also exposed to the air twelve slips of white blotting-paper, moistened with a like mixture of white starch, etc. At different periods these were all tested by dilute sulphuric acid, and remained unaffected. I assume, therefore, that the atmosphere in this place is free from iodine. W. B. K.

114.—Mounting Chitine.—I have found no difficulty in rendering chitine transparent by immersion for a short time in potash, after which I mount in Canada balsam. H. W. Lett, M.A.

117.—Spots on Sycamore Leaves.—There are two answers to Mr. Drummond's question in *Science Gossip* for this month. The first requires some explanations. It is as follows:—"The black spots and patches on the leaf of the sycamore have been caused by drops of rain, or dew, acting as sun-burners by condensing the solar rays."

This seems rather strange, for how could sufficient heat be generated *under water* to carbonise organic matter? Or, is it meant that the drops hang so conveniently from the leaves that they focus the sun's rays exactly on other leaves below them?

The second explanation seems far more natural, but, not having examined any of the leaves in question, I cannot answer for its accuracy. It is that the spots are due to some fungus, possibly "*Capnodium Footii*," though I have not found the sycamore mentioned as one of its hosts. I should very much like to have the first answer (?) commented upon by some of the readers of the *Scientific Enquirer*. A. W. L.

117.—Spots on Sycamore Leaves.—I have no doubt that the black spots on sycamore leaves, referred to by W. B. D., are caused by the fungus, *Rhytisma acerinum*. It is very common about the end of the summer, every leaf of the tree sometimes being affected. The spots are about half-an-inch in diameter (sometimes more), very black on the upper surface, and of a light brownish colour on the under side. H. Purefoy FitzGerald.

117.—Spots on Sycamore Leaves.—The black shining spots which appear and are so abundant on the leaves of the sycamore in the summer, are a well-known fungus, *Rhytisma acerinum*; there is another, *R. salicinum*, which is common on willow leaves. I once saw it stated that these *Rhytisma* spots were caused by rain drops acting as a lens and burning the leaves! A mistake patent to anyone who takes the trouble of using a burning-glass on

similar leaves, as I have often done, with the invariable result of a faded, dirty, pale-brown, withered colour. A green leaf when burned does not turn black as does a stick. Moreover, the spermatia, or sporidia, which are the seeds for reproducing the *Rhytisma*, abound in the black spots on the sycamore and willow leaves. There is a figure of the latter species in M. C. Cook's "British Fungi," Vol. II., p. 756. The *Rhytisma acerinum* is the only black spot I have ever met with on the leaves of the sycamore tree. H. W. LETT, M.A.

117.—Spots on Sycamore Leaves.—The spots on the sycamore leaves are caused by a fungus (a very common one) called *Rhytisma acerinum;* in the autumn it is not much developed, but if in the spring, the dead leaves are gathered up from under the trees, and then examined under the microscope with a high power, the fungus will be found in a more matured condition.

M. A. HENTY.

118.—Carbolic Acid and Cement.—I have found Brown cement (shellac dissolved in alcohol) sufficient to ring objects mounted in a *weak* solution of carbolic acid (1 per cent.) After treating the chitine in a strong solution of carbolic acid until the imbrication is plain, I would suggest mounting it in the weak solution already referred to, ringing twice with brown cement, and when hard, ringing again with any of the common mediums, such as zinc white. B. Sc., Plymouth.

119.—Ringing Slides.—Such a space as that referred to by H. A. S. cannot be filled at one operation. Your correspondent has no doubt tried to do so, and hence the failure. The first ring of white zinc cement should not be put on too thick, and if not sufficient to cover what is desired, a second is to be added when the first is dry, and even a third if the others do not suffice, always allowing the previous ringing to be quite dry before adding another. The brush should be a small red sable, and should be kept as full of the white zinc cement as it will hold without dropping off. The brush should always be most carefully cleansed with benzole after use, and the hairs left smoothed to a fine point, otherwise a neat ring cannot be laid on a slide when next required.

H. W. LETT, M.A.

120.—Name of Bed-Bug.—The explanation of your correspondent having found out that the Bed-bug is called by two names, is simply that he has met with one of those changes in nomenclature which are the plague of naturalists, and of making which there seems to be no end. Your querist must have but a slight acquaintance with works on Natural History, or the circumstance alluded to would not have puzzled him. What would he think of no less than twenty-two different names given by

muscologists to one moss, and yet I find such to be the case in the list of synonyms at pp. 173-174 of Dr. Braithwaite's "British Moss Flora."

However, *Acanthia lectularia* seems to be the name of the insect at present adopted by zoologists, as Dr. Duncan uses it in his Natural History, Vol. VI., p. 107, published by Cassell.

H. W. LETT, M.A.

120.—Name of Bed-Bug.—CIMEX is the general name (Linn.) of Bug. Order Hemiptera: family *Cimicidæ.* In the "Micrographic Dictionary" the following species are enumerated and described:— *C. lectularius* (bed-bug). *C. columbarius* (bug of pigeon). *C. hirundinis* (of the swallow). *C. pipistrelli* (of the bat). I do not find the word *Acanthia.* Acantha, from the Greek ἄκανθα (a thorn), is applied in botany to many seeds that are clothed with hairs composed of hygroscopic cells. W. B. K.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed before beginning their replies.

122.—Japanner's Gold-Size.—My gold-size has formed a thick, insoluble sediment, and the fluid floats on the top. It is quite useless as it is. Can anyone give the reason, and a remedy if there is one? It is a year or two old. A. F.

123.—Re-silvering Reflector.—Can anyone give directions for re-silvering the reflector of a 6-ft. reflecting telescope? It has got badly scratched. If it is not impossible to do it, I should prefer doing it myself to sending it to an optician. A. F.

124.—Mushrooms.—Why do the cultivated mushrooms and the wild mushrooms behave so very differently in their growth? The former generally first appear above ground like tiny white peas, and gradually increase in size (which process takes from a month to six weeks), until they reach maturity; whereas the wild ones spring up in a night. M. A. HENTY.

125.—M. Pasteur's Discoveries.—Has Pasteur published any work in English upon all the wonderful discoveries he has made with respect to Silkworm diseases, enteric fever, splenic fever, etc.? Papers appear upon these subjects from time to time in newspapers, periodicals, etc.; but as a reference, and to read, a work containing all these matters would be much more satisfactory.

M. A. Henty.

[No. But Lady Hamilton has translated Pasteur's "Life" written by his son-in-law. This contains a very full account of his researches on Silkworm diseases, splenic fever, and other forms of fever, and just touches on his Hydrophobia researches. We believe the work was published by Longmans, in 1885.—Ed.]

126.—Micrometer Ruling.—Will some reader of the *Enquirer* tell me how to construct a machine for ruling micrometer lines on glass and on metal; also state the probable cost? Perhaps a drawing could accompany the description. Micro.

[If any of our friends will forward a reply with neatly-executed pen-and-ink *line* drawing, we will reproduce it. All drawings sent should be in *fine* pen-and-ink *line* work. They should not be folded.—Ed.]

127.—A Point for Investigation.—Recent researches show that the bright blue colour of the blood of limulus and of scorpions is due to the presence of copper. This suggests another micro-chemical research, which might be profitably followed.

V. A. L.

128.—Photo-Lithography.—I shall be glad of instructions for the production of Photo-Lithographs, either from photographs or drawings. Will some kind reader help me? S. B. D.

129.—Object-Glasses.—I have become very recently the possessor of a microscope, and am much puzzled on one or two points which I have no doubt your readers can readily explain. I find that the $\frac{1}{4}$-inch object-glass requires to be brought to within nearly one-eighth of an inch to the object to get it to the proper focus; whilst a $\frac{1}{4}$-inch object-glass of foreign make in the possession of a friend is in focus at a quarter of an inch. What causes the difference in focal distance, as, for anything I can see to the contrary, the magnifying power is the same in each? Amateur.

130.—Micro-Polariscope.—I have seen the analyser used in various positions—viz., above the eyepiece, just above the object-glass, and made to slide in the tube. In either of the first two positions the operator has the opportunity of revolving the analyser; in the latter it is of course permanently fixed. If the polariser revolves, is *any* advantage gained by revolving the analyser also, and if so, *why?* And all advantages and disadvantages

considered, which is the best position to place it? Has *cost* anything to do with its being placed in certain positions in preference to others? MICRO.

131.—Electric Light.—Can I construct a battery capable of generating sufficient electricity to feed an electric lamp which will possess sufficient illuminating power to light room, say, sixteen or eighteen feet square? If so, must the battery be brought into the room, or may any length of wire be used? Will anything be gained by using a magneto-electrical machine in conjunction with the battery? I may say that I am quite a novice on all electrical matters, but shall be glad to be informed. NOVICE.

132.—Magnifying Power of Objective.—Will some one who knows tell me how to find out the exact magnifying power of my objectives used in connection with the different eye-pieces? And in making camera-lucida drawings, how may I state positively the actual degree of magnification of the object drawn? AMATEUR.

133.—Hæmatoxylin.—How is this stain prepared for micro-work? A. S. C.

134.—Land and Fresh-Water Shells.—I am desirous of making a collection of these, and shall be glad of instructions as to how to proceed, and, more particularly, how to succeed. What books would you recommend to help me to classify and arrange them?

I should like also to preserve for microscopic purposes the Palates of the various Molluscs. How are they to be found, taken out, prepared, and preserved? SNAIL.

Assisting Naturalists.

R. A. R. BENNETT, Walton Manor Lodge, Oxford.

Subjects—Chemistry, Photography, Marine and Fresh-Water Aquaria.

Answers to Correspondents.

All contributions should be addressed to the Editor of the *Scientific Enquirer*, 1, Cambridge Place, Bath, and not to the London Publishers. MSS. should be written on one side of the paper only, and signed for publication on the right-hand bottom corner. The full name and address of writer should be placed at the left-hand corner, and when so placed, it will be understood that it is *not* to be published. Contributions SHOULD reach us before the 10th of the month, and cannot be inserted unless we receive them before the 14th.

F. R. BROKENSHIRE.—Your interesting letter came too late for insertion in the present issue. Please write to us before the 10th of the month in future if possible.

L. F.—You unwisely sealed your MSS., and as you only used a half-penny stamp, we were of course surcharged on receipt. MSS. may be posted in a half-penny wrapper, but they must not be attached to it, and should always be addressed to "The Editor," marked "MSS. for publication only."

Dr. T. M. D-—Thanks for kindly assisting us.

M. McK.—Your second paper is to hand; we shall hope to use it in November.

J. S. P.—The volumes of *The Young Collector* Series, published by Swan Sonnenschein & Co., London, at 1s. each, will we think be just the works to suit you.

Communications have been received from B. Sc., Plymouth, W. E. Green, H. E, Hurrell, V. A. L., F. R. Brokenshire, H. L. B., A. B., T. D., E. H. R., B. H., G. H. L., C. L., C. S., G. E. B., J. W. N., S. W., Hereford, R. W. Goulding, K. H. J., J. J. A., J. R. B. L., F. S., M. E. T., P. V., F. Steel, W. Brock, H. W. C., Cotham.

We beg to remind our friends that the fifth volume of *The Journal of Microscopy and Natural Science* will be ready about the middle of October, handsomely bound in cloth, gilt, bevelled edges, and may be had of all booksellers, price 8s. 6d. London: Messrs. Baillière, Tindall, & Cox; or of the Editor, 1, Cambridge Place, Bath.

Sale and Exchange Column.

Spinnerets of Spiders, Stained, and mounted, without pressure, for other good mounts. Lists exchanged.—W. E. Green, 24, Triangle, Pristol.

Will exchange Nos. of "Chemist and Druggist" for 1880, or ditto of "Pharmaceutical Journal" for 1879, for "Ponds and Ditches," or "British Fungi," or similar works, or back Nos. of "Journal of Microscopy," or well-mounted slides.—H. W. Case, Cotham, Bristol.

Beautiful Plant Scales.—For leaves of the Sea Buckhorn (*Hippophæ rhamnoides*) covered with beautiful polarising scales, or for opaque objects; send stamped addressed envelope to H. E. Hurrell, 1, Church Plain, Great Yarmouth.

Worked Flints, Paleolithic and Neolithic, in exchange for Fossils.—Apply to J. French, Felstead, Essex.

Microscopical Slide Labels for Animal and Vegetable Kingdom, toned paper, 6d. per 100; samples of 33 kinds, 2d.—Chas. Watkins.

Insects in Spirit and Dry, selected for Mounting. New List ready.—Chas. Watkins, King's Mill House, Painswick, Gloucestershire.

High-class Injections from Monkey, consisting of lip, tongue, liver, lung, spleen, finger. The six slides for 5s.—Henry Vial, Crediton, Devon.

For Sale.—Steward's Educational Microscope. One eye-piece, combined, 1 in. and ½-inch objective Analyser and Polariser, with Selinite slide, stand, condenser, live box, coarse and fine adjustment. In Mahogany case. Good condition. Price, £2.—G. F. Bergin, jun., 43, Fernbank Road, Redland, Bristol.

The Scientific Enquirer.

NOVEMBER, 1886.

*The Study of a Few Common Plants.**

BY GEORGE L. GOODALE.

VII.—PLANT-GROWTH IN GENERAL.

PLANT structure consists of minute cells of different shapes, variously arranged and compacted. Plant growth consists in the production of new cells, and their increase in size, at the cost of material prepared by foliage.

Of course, this elaborated material must undergo many changes before it can be used for the building up of new cells. So far as shapes of cells are concerned, it is now necessary to refer to only three principal forms :—1st, spherical, or nearly spherical, these are generally compressed somewhat into polyhedrons by contact with other cells (as in the pith of Elder); 2nd, elongated cells, which may be either cylindrical or spindle-shaped, that is, tapering at both ends (as in wood-cells); 3rd, flattened cells of many sorts.

When the wall of a cell is first formed, it is very delicate. In most cases, it speedily undergoes changes in its thickness and toughness. The thickening is seldom even. Its irregularities, therefore, give rise to dots and pits and pores, and many curious markings; but these can be seen only under the microscope, and need not be further spoken of here. It is enough to observe now that the thick-walled cells in plants are generally of the second sort; that is, they are elongated. They become sometimes very long and tough, and have only a small cavity, or none at all, within: these are called *fibres*. The other long thickish-walled cells, which are rather more brittle, are, with all their varieties, called wood-cells. An interesting form of wood-cell gives rise by its development to what are known as ducts. The cells are formed in chains, and the partitions between the cells break down,

* From "Guides for Science Teaching."

leaving a jointed tube or duct. Another very common form of wood-cell is spindle-shaped and flattened.

To trace out the development of all these fibres and wood-cells, from the simple kind from which they rise, is a task wholly foreign to the present series of papers. It is enough to state that these cells, which in their varied forms give rise to the complex fabric of plants, are marshalled in definite order. Only a few of the more frequent modes of arrangement are now to be mentioned, and these only for the purpose of showing that a study of our common woods and barks, even without the aid of a lens, may be not only practicable but very instructive.

Plants which do not have woody stems are not at present to be considered. The herbs which have only very imperfectly formed wood, and the plants whose tender soft-wooded stems are killed by the frost, are to be left out of account. Any shoots of our trees, or hardy shrubs with thick bark, are available for illustration of the present subject. Willow, Poplar, Elm, Horse-Chestnut, Maple, or Ash will answer perfectly. If the newest part of the shoot is compared with that produced two or three years before, it will be seen to differ in many respects. In the latter, the pith is less conspicuous, there are other rings outside the first circle of wood, the bark has a firmer lining and a rougher exterior. Compare this older shoot with one which is five or more years older still, and the differences are more manifest. The outside layer is made up of a sort of cork which is beginning to crack here and there, giving to the bark a very irregular surface. This outer layer consisting of cork might be taken from the plant without any injury, if carefully done. The cork bark of commerce, a very thick layer of this kind, is taken off from live trees of the Cork Oak in this way; and then the trees produce another belt of cork, to be removed in a few years more. The number of years can be easily counted from their record in the compact layers.

The inside layer of the bark consists of fibres which are frequently so conjoined as to form a kind of lace, fine in the lace-bark of the West Indies, coarse in our Linden. The fibres of Linden constitute bast-matting or Russia-matting. The fibres of hemp for cordage, of jute and flax ready for spinning, are bast-fibres which have been detached from the rest of the plant either by mechanical means, by chemical processes, or by what amounts to pretty much the same thing as the latter, decomposition. With the one marked exception of cotton, which consists of the plant-hairs on cotton-seeds, the textile fibres of the arts are bast-fibres. Indian Corn, Bamboo, and Rattan have their bast-fibres, with groups of wood-cells and ducts, scattered all through the stem, but ending for the most part at its very outside, here forming a dense cylinder not separable from the rest of the stem. In these cases,

the distinct clusters of bast-fibres and ducts are packed firmly by means of spherical cells. The bast-fibres in the thicker leaves of plants of this sort—for instance, Century Plant and New Zealand Flax—are easy to prepare for use as cordage, etc., and they are strong and good.

For the present purpose it may be said that the wood used in the arts is of two kinds, namely, that which consists only of wood-cells, properly so called, and that which has also ducts, or tubular vessels, either large or small. The wood of the coniferous trees has no ducts, except sometimes at the very centre : it is made up of spindle-shaped cells, which are more or less flattened. Such woods as Oak, Ash, and Elm have proper wood-cells and ducts besides; in many instances, the latter are very conspicuous, and give to the cross-section of the stem an open, porous look. Certain differences in the character of the wood-cells and the ducts, probably depending upon varying pressure exerted by the bark, are observable between those formed in summer and in autumn. These differences are often clearly marked, and give rise to the well-known rings of wood. The thickness of the rings denotes the amount of wood made during a single year. The new wood is made by the multiplication of closely packed cells which lie between the wood and the bark. These layers of closely packed cells have a double work. Upon one side they build new wood; on the other side they lay down a new film of inner bark or bast. In the spring, when these layers (the cambium or meristem) begin their work of forming new tissues, they constitute the juicy and sweetish substance found under the bark. The sweetness results from the presence of a kind of sugar which is made at that time from the stored-up starch. Removal of the cambium, of course, prevents the production of any more new wood or bast at the place of injury. Often, however, if the wound caused by its removal is not too serious, it may be healed over by thin films of freshly made cork.

A very slight examination shows that the width of the year's wood varies considerably in different years, and on different sides of the stem. Moreover, the wood nearer the centre is denser than that just under the bark ; the former is the heart-wood, the latter is the sap-wood, and is the last formed. In some stems, the irregularities in the rings are very striking : in one case, we have observed, the parts of two rings are sometimes confluent. Radiating from a point not far from the centre, many very slender lines run in a somewhat broken manner out to the bark. These are the pith-rays. They lie between the wedges of wood, and, when they are seen in section, appear as shining surfaces. These constitute the silver-grain of wood. Here, then, are two things, each of which will look very differently in different slices of wood.

Pieces of wood cut in different ways will be found to be frequently puzzling, but useful objects of study. The student should endeavour to identify the silver-grain planes, or the pith-ray lines, and to make use of these in connection with the circles of which they are radii, to ascertain certain facts respecting the specimen. For instance, suppose a small prismatic block of wood, cut from an oak stem which is twenty inches in diameter; it will exhibit on its different sides different exposures of the rings, or cylinders, and the pith-rays, or planes; and from an examination of these it will be possible to detect the place from which the block was taken. The difference in colour between the heart-wood (the older) and sap-wood (the newer), the differences in size between the inner and the outer circles afford easy marks by which the position of the block with respect to the stem can be ascertained. If the plane sides of the block are not at right angles to each other, the problem becomes more difficult; but it is always an interesting one. Questions respecting the position which a block or a board must have had in the log from which the piece has been cut will generally be found within the reach of all by the exercise of a little thought.

Specimens to illustrate the subject of the texture of woods may be obtained from cabinet-makers and others who use veneers. These thin slices of wood, which so well display the characteristic texture or grain, should be securely glued to somewhat thicker slices of cheaper woods. Specimens prepared in this manner exhibit very beautifully most of the features which have been referred to under the subject of circles and silver-grain.

The branches which fall off from decay or are broken off by injury leave roughish projections, which sooner or later are healed over by the subsequent growth of the stem. The buried trace of the branch remains as a concealed knot, and frequently disturbs for a while the regularity of the wood formed in its immediate proximity. When the branches are small and exceedingly numerous—especially if they are short and hard, as if the buds from which they sprang had given rise only to a blunt thorn—the disturbance of the layers of wood produces some of the most beautiful of the ornamental woods.

When the terminal buds of the main stem and of the branches of our trees expand fully for the season, their growth in length is arrested. The growth of the stem or branches in length in the following year is solely by the expansion of new buds. If two nails are driven into a stem, at a definite distance from each other, that distance will ever afterwards remain the same. It must be remembered, however, that the shape of a tree is constantly changing year after year, from the loss of branches, chiefly the lower and shaded ones, which do not have a fair chance; and so

the main trunk appears to carry the crown of the branches higher and higher up. The relations of the position of buds to the ultimate shape of the tree, and of the relative strength and vigour of buds to the form at last attained, are easily observed with a little care. It is like comparing a finished building with the sketch made before it was erected.

The spire-like and spray-like forms of shade trees should be carefully studied, and the grown tree compared with its plan laid down upon a branch with buds.

Short Papers and Notes.

Insectivorous Plants.

HAVING seen a fine collection of the different glands of the pitcher plant *(Sarracenia)* prepared as microscopic slides, and having myself found a number of Sundews *(Drosera rotundifolia)* on a boggy moor, their favourite habitat, I mounted some of their leaves, as slides, to examine the glands they use in digesting captured insects. In the scientific world great discoveries are being made as to the Insectivorous plants, but as we cannot all procure the larger kinds, such as *Sarracenia*, I would like to describe here two of our common wild flowers that belong to the same class. Of all the pretty sights of a morning in summer, nothing can rival the little red Sundews, as they lie dotted over the moss and heath, glittering in the sun. Each plant consists of a small red rosette of leaves, out of the middle of which a tiny flower raises itself, and the upper surface of each leaf is covered with numerous hairs, which end in a glandular knob, and which have been termed "*tentacles.*" These glandular knobs are surrounded by a very viscid fluid, which from its brilliance in the sun, secured the pretty name of Sundew for the plant. If you examine a leaf of the plant, you will find that the tentacles are short and erect in the centre, but towards the margin of the leaf they are much longer, and lie out like a fringe; and the glandular knobs consist of two small cells filled with a purple fluid. It is a beautiful object under the microscope, and each part described can be clearly seen. And now as to the manner in which the leaves entrap the insect, and the digestive process. If an insect or any small animal alights on the short tentacles in the centre of the leaf, all the surrounding tentacles immediately begin to move, and inflect themselves over it, the ones nearest the centre moving first, and so on, to the margin of

the leaf, till every tentacle is in use. But to produce this inflection of the tentacles, the insect must not only come in contact with the glittering secretion on the glands, but in contact also with the glands themselves, and this is done by the insect absorbing the secretion, and sinking through it, to the surface of the glands; when all assist in killing it. When an insect is thus entrapped, an extraordinary change takes place in the secretion on the glands, as it at once turns acid, and instead of containing merely a purple fluid, the cells of the gland are seen to contain different shaped masses of purple matter suspended in a colourless fluid. This resembles the gastric juice of the higher animals, is the true digestive agent, and seems to possess an antiseptic power. The roots of insectivorous plants are so small, and so weakly developed, that unless they possessed this power of digesting and otherwise of absorbing animal food, they would have quite an insufficient supply of nitrogenous matter to subsist on.

The next common wild flower belonging to the insectivorous class I will describe, is the Common Butterwort *(Pinguicula vulgaris).* This is also very common on marshy ground, and is one of our loveliest wild flowers. It lies on the damp verdant moss to which it is so partial, like a pale green rosette of leaves, from the centre of which a flower stalk springs, long and delicate, bearing a dark purple flower. The margins of the leaves are slightly incurved, and the upper surface thickly strewn with glands which secrete a viscid colourless fluid. When these glands are excited by the pressure of an insect, the margins of the leaves roll in upon them, and thus the insect is brought into contact with many more of the glands, which induces them to secrete the digestive fluid more freely. The work of the margins is actually to push the captured prey into contact with as many glands as possible. The incurving of the margin serves another purpose, as when many of the glands secrete the fluid, it trickles down and is caught by the margins, so that insects are more quickly and completely dissolved there. It is only nitrogenous substances that cause the secretion to become acid, and it is in this state that it has the power of digesting insects or any animal matter. Before the absorption of animal matter the glands are green, but after that takes place the fluid contained in them becomes aggregated and is of a brown colour. Thus these two humble wild flowers have a busy life in capturing and digesting their food, and the study of them is so interesting that it will repay any trouble.

MINNIE MCKEAN.

A Gigantic Sea-weed.

Captain John Stone, commander of the ship *Clever*, recently

carried to Montevideo some remains of a gigantic sea-weed that he picked up near the equator. While overtaken by a dead calm in these regions, the sailors perceived an object floating on the surface at some distance from the ship. Manning a boat, they rowed up to it, and found to their surprise that it was an alga of the extraordinary length of 1,500 feet. From an examination of the specimens collected, botanists identified the plant as *Macrocystis pyrifera*.—*Scientific American.*

A Surgical Swallow.

Dr. F. Morgan, of Leavenworth, Kansas, communicates to the *Medical Record* a story which would indicate that swallows have considerable surgical skill as well as intelligence. In a nest he found a young swallow much weaker than its mate, which had one of its legs bandaged with horse hairs. Taking the hairs away, he found that the bird's leg was broken. The next time he visited the nest he found the leg again bandaged. He continued to observe "the case," and in two weeks found that the bird was cautiously removing the hairs, a few each day. The cure was entirely successful.—*Pop. Sci. Monthly.*

Pinhole Camera.

The *Scientific American*, July 24th, 1886, gives an illustration of a camera for photography, in which the *ne plus ultra* of simplicity may fairly be said to be attained. It is a little round tin box, exactly like one of the better kind of "shouldered" pill boxes, two inches in diameter and three-quarters of an inch deep from cover to bottom. A hole was punched in the centre of the cover, and over this a piece of foil was secured by varnish. The foil was taken from a button card. Small mother-of-pearl buttons are generally mounted on pieces of pasteboard with the foil under them. Through the foil, where it extended across the hole in the box cover, a hole was made with a No. 10 needle. The needle was pressed through until its point could just be felt by the finger held against the opposite side of the foil. This made an aperture one-sixtieth inch in diameter. The interior of the box was blackened. A piece of Eastman's "A" bromide paper, cut circular, so as to fit in the box, was placed in it against the bottom, and the cover put on. This, of course, was done in the absence of actinic light. Then with an exposure of four minutes, at a distance of about 10 feet from the object, the negative was taken. It was developed with oxalate developer. Castor oil, or vaseline, was used to make it transparent, so as to adapt it for printing from.

As nothing special—neither paper, glass negative, nor developer—was used, this process of pinhole photography deserves special mention. It might often be of special use in emergencies that sometimes will present themselves to the photographer.

The special novelty that presents itself is the use of paper instead of glass for the negative, as paper can be cut to fit any size and shape of the box. The brand of paper employed is slow paper; it would be interesting to try a quicker paper that would reduce the necessary time of exposure.

The above appears so thoroughly plain that we think it unnecessary to reproduce the engraving by which it was accompanied.

Tobacco.

A contemporary estimates that coca is used by 10,000,000 of the human race; betel nut by 100,000,000; chicory by 40,000,000; coffee by 100,000,000; 300,000,000 eat or smoke hashish; 400,000,000 use opium; 500,000,000 use tea; and "all people that on earth do dwell" are addicted to the use of tobacco.

The Hessian Fly.

We learn from the daily papers that in some of the cornfields of Essex and Herts, examples of the Hessian fly in the pupal form have been discovered; but no serious damage is expected from the pest this season. At the request of the Lords of the Committee of the Council, Mr Charles Whitehead has proposed a series of observations, directing agriculturists how best they may stamp out this dangerous intruder.

On Cell Cements and Finishes.

The frequent inquiries which have appeared in the pages of the *Scientific Enquirer* induce me to note down a few of the results of my own practical experience in the use of cell cements and finishes for the benefit of younger workers. Those who delight in an ornamental finish to their mounts will, of course, require as many media as there are colours desired. But for those whose aim is to put up plain, neat slides for study, I am convinced that two preparations are all that are required, and these I would enumerate as (1) shellac varnish, and (2) gold-size and lamp-black.

Take the common brown shellac which is sold in the shops in thin flakes, and dissolve it in alcohol. It gives a muddy, yellowish-brown solution. Make it quite thin, and run through coarse filter-paper. The filtrate will be of a beautiful dark amber colour,

the flocculent and insoluble portion remaining on the other side. This fluid will be altogether too thin to use. Half-fill a wide-mouthed ounce bottle with the solution, tie a piece of paper loosely over the top to exclude dust, and set it in a warm place. In a few days it will be found to have thickened sufficiently, so that when a brush is dipped into it, and drawn along on a slide, the shellac solution will not spread outside of the mark made by the brush. It is now ready for use. Put a small sable brush through the cork, so that it will reach nearly to the bottom of the bottle, and rub the cork well with glycerine to prevent its sticking. With this medium, when at the right density, a cell may be built up by successive layers applied on the slide revolving on the turn-table, an eighth of an inch in depth without any flowing-down of the walls. Set the slides away in a drawer, or other place free from dust, and let the cells harden gradually. After partial drying they may be carefully heated over a spirit-lamp until they *begin* to turn dark and smoke. Cells treated in this way are very hard, and will hold fluid balsam perfectly. For common use, however, the heating is not necessary, as a well-dried shellac cell will hold any ordinary mounting fluid.

Take old gold-size, thin it as much as may be necessary with turpentine, and add lamp-black to give it a deep colour. This dries with a handsome gloss, and is hard, and at the same time tough. I have glycerine mounts put up several years ago, and sealed with this cement, which have never changed in the slightest degree. This may be used as a finish for balsam mounts if a coat of the shellac is applied previously and allowed to dry, to prevent the black turpentine striking into the balsam.

A neat ring of the shellac run round the edge of a balsam mount looks well, and is a perfect protection against the action of cedar oil. It may be mentioned in passing that cedar oil is not favoured as an immersion fluid by our eminent optician, Spencer, nor by other American artists of less note. They furnish with their homogeneous immersion objectives a nearly neutral fluid which does not affect balsam in the least.

The ring of shellac varnish mentioned above will also check the drying and cracking, and the intrusion of air under the edge of the cover glass, which may sometimes be observed in old balsam mounts, even by such preparers as Möller and Bourgoyne.

A. L. Woodward, New York.

Sagacity of Crows.

A story of two sagacious crows is told in *Land and Water* by Rev. F. O. Morris, on the authority of a land-owner of Lock Orr, who saw the birds annoying the hares. Although he could not

see clearly on account of the high grass, he was sure the hares had young ones, which the crows were trying to carry off. After the hares had fought the birds for some time, one of the "black robbers" managed to attract their attention, and led them off a little, while his confederate flew round and seized a small animal, which screamed loudly when both birds flew away. He was satisfied that their purpose had been to get one of the young ones of the hares, and that they had succeeded.

Mystery Gold.

This is described as an alloy resembling gold in appearance and weight, and resisting the jeweller's test of strong acids. Its analysis is given as follows : Silver, 2·48 ; Platinum, 32·02 ; Copper by difference, 65·50. Strong boiling in nitric acid, even when the article made of it is left in it for some time, has apparently no effect upon the alloy, which is coming extensively into use.

White Resin as a Mounting Medium.

Mr. Wm. Wales recommends white resin as a good medium for mounting. He says that it is easily soluble in alcohol, melts readily, cools quickly, and is more transparent than balsam. He has found it a better material than balsam for cementing lenses, and this he deems a good test. Mr. H. L. Brevoort indorses Mr. Wales's statement, and gives the following as his method of using the material :—

On the centre of a clean glass slide laid on the heating table, I put a small piece of resin of the purest quality. Heat is generally applied until the resin becomes as liquid as it can be made without burning it. To remove air bubbles, with a pointed glass rod I add to the liquified resin, and stir in with it, half a drop of turpentine. A moment or two after the object to be mounted has been placed in the medium and the cover-glass has been dropped upon it the slide must be removed from the hot table and a spring clip applied. In five minutes the mount will be ready for finishing and labelling.—*Scientific American.*

The Power of a Microscope.

The magnifying power of a microscope centres in the lens. The magnifying power of a lens depends upon its focal length, the object being, in fact, placed nearly in its principal focus, or so that the light which diverges from each point may, after refraction by the lens, proceed in parallel lines to the eye, or as nearly as is requisite for distinct vision. The focal length of the eye usually

ranges from six to fourteen inches, so that they assume ten inches as near the true average. Thus a lens whose length is one-sixteenth of an inch is said to magnify 160 times.

To Find the Height of a Tree.

All the apparatus required is a straight stick of any length. Draw a circle with its radius—*i.e.*, half the diameter, a little less than the length of the stick. This may be done by holding one end of the stick, say two inches from the end, and moving the other end around, making the circle with a chip or knife. Then place the stick in the ground exactly in the centre of the circle, and press it down until the height of the stick is exactly the same as the radius of the circle. When the end of the shadow of the stick exactly touches the circle, then also the shadow of the tree will be exactly in length the same measurement as its height. Of course in such a case the sun will be at an exact angle of 45 degrees.

Tabanus bovinus.

According to De Geer there is yet another genus of Bot flies known as the Ox Gad Fly *(Tabanus bovinus).* But before beginning the consideration of this fly, I will just remark that such boundless confusion and really serious difficulty in understanding the subject has arisen from the indiscriminate use of the names Gad fly, Bot fly, Breeze fly, and other appellations, that it will be well, first of all, to attend to this matter, so that we may be sure what we are speaking about. The "Gad flies," properly so called, have nothing at all to do with raising warbles on the backs of cattle, or causing deposits of maggots inside farm stock, whether in their nostrils, stomachs, or elsewhere. They only do harm in their fly state as blood-suckers. The proboscis encloses an apparatus of sharp, lancet-like points, with which the female pierces the skin and draws away the blood of the attacked animals; and here we have a good reason for confining the name "Gad fly" solely to this family; its mouth is filled with a packet of most effective gads, or goads, which distinguish it clearly if seen, and, if not seen, may be often known by the blood flowing from the puncture on the animals. Further, the Gad fly maggots live, as far as we know, in the ground or decaying vegetables, and not in animals.

In the case of the Ox Gad fly *(Tabanus bovinus)*, the grubs or maggots are long, worm-like, narrowest at each end, footless, but having a distinct head, and the chrysalis is in shape somewhat like

the maggot much shortened, and showing the shape of the coming wings.

Other quadrupeds and even the human biped suffer sometimes from the bites of these flies. I once saw my father's face with a stream of blood on it caused by a wound made by one of these flies. Horses are sometimes greatly irritated by them and manifest a disposition to bolt when in harness, from being bitten on the abdomen, or thigh, near the flank, and are pronounced vicious brutes accordingly by those who do not enquire the cause.

H. W. C., Cotham.

Bees in a Church.

The Christian Church at Harmoney, near Oakland (Illinois), has been inhabited by bees for a number of years. The bees took up their abode in the wall behind the pulpit. The pastor of the church has been annoyed by them, and they finally got so bad that they drove the pastor, people, and all out of the church, and had undisputed possession. The other day a crowd collected and ripped the siding off from the foundation to the roof, where they thought the bees were located. After getting the siding off, the men found that the bees had deposited their honey in the wall between the studdings, that space being completely filled with honey to the height of 16 feet. The honey was carried away in wash-tubs and pails, and divided among the people living near.—*Daily Telegraph*, August 17th, 1886.

Water-Testing.

The following tests for water should be made widely known among those interested in water supply :—For hard or soft water : Dissolve a small quantity of good soap in alcohol. Let a few drops fall into a glass of water. If it turns milky, it is hard ; if not, it is soft. For earthy matters or alkali : Take litmus paper dipped in vinegar, and if, on immersion, the paper returns to its true shade, the water does not contain earthy matter or alkali. If a few drops of syrup be added to a water containing an earthy matter, it will turn green. For carbonic acid : Take equal parts of water and clear lime water. If combined or free carbonic acid is present, a precipitate is seen, to which, if a few drops of muriatic acid be added, an effervescence commences. For magnesia : Boil the water to a twentieth part of its weight, and then drop a few grains of neutral carbonate of ammonia into a glass of it, and a few drops of phosphate of soda. If magnesia be present it will fall to the bottom. For iron : Boil a little nut-gall and add to the

water. If it turns grey or slate-black, iron is present; (2) dissolve a little prussiate of potash, and if iron is present it will turn blue. For lime: Into a glass of the water put two drops of oxalic acid and blow upon it; if it gets milky, lime is present. For acid: Take a piece of litmus paper. If it turns red, there must be acid. If it precipitates on adding lime water, it is carbonic acid. If a blue litmus paper is turned red, it is mineral acid.

Dermatine.

"Dermatine" is the name given to a new artificial product intended as a substitute for gutta-percha, india-rubber, and leather. It can be made of any thickness, and as pliable as required. It is said to be suitable for the "packing" of machinery, for railway buffers, rings, tubes, for boot soles, and for insulating electric wires. It is prepared from copal gum, preferably the Kauri or Manilla gum. The gum in powder is dissolved in turpentine or naphtha in a jacketed pan, fitted with stirrers. For india-rubber sulphur is added, and albuminous matter prepared from lichen or other vegetable products. The whole is boiled and masticated, and more albuminous matter added. Slaked lime or French chalk may also be added, and a proportion of old rubber. The process, in fact, admits of considerable variation, according to the properties of the particular kind of dermatine required.

Answers to Queries.

62.—Holes in Live-box.—In answer to F. N. P.'s query I may say that the holes he mentions are merely made for "chucking" the metal while it is being turned. My authority is Mr. Swift, of Tottenham Court Road. A. W. L.

14.—Stratena.—This is a patent cement which is very popular in the U.S. The exact composition is not made public, but I have found the following to closely resemble it and answer every purpose of the genuine article. Take of

Acetic acid (36 per cent.)	9 fl. ozs.
Best white glue	6 troy ,,
French gelatine	1 ,, ,,
White shellac varnish (thick)	1 fl. ,,
Distilled water	8 ,, ,,

Dissolve the glue in the acetic acid, and the gelatine in the water by the aid of a gentle heat. Mix the two solutions and continue

the heat by aid of a water bath until a uniform solution results. Then add the shellac varnish and mix thoroughly for use.

H. M. Whelpley, St. Louis, Mo., U.S.A.

83.—Cyclops and Entomostraca.—Has Mac tried carbolised water? Procure a small quantity of carbolic acid crystals, add a drop or two of water to facilitate melting by gentle heat over a gas flame, and pour out, say 5 or 6 minims, into half-a-pint of distilled water. The fluid may be placed with the object in a shallow cell, formed by a tin ring cemented to the glass slip with brown cement, and the cover fixed with the same material. When dry, finish as usual with zinc cement. Bladderwort and various specimens of pond life are thus successfully mounted: Daphnia, Canthocamptus, Cypris, Diaptomus, etc. V. A. L., Manchester.

85.—Diatoms.—In addition to the American pamphlets mentioned by Mr. E. S. Courroux in the August number, I have procured through the recommendation of a member of the P.M.S. the "Collector's Handy-book of Algæ, Diatoms," etc., by Johann Nave (published by W. H. Allen and Co.), and which, as a beginner, I have found a most useful work. J. B. Bessell.

87.—Asphalte Varnish.—I have been a good deal surprised at the strong terms in which this cement is condemned by some correspondents. I have used it for fluid mounts with very good success. Some slides put up 20 years ago are good still. I very rarely get it run in or spoiling the slide in any way. One reason of this is I allow the cell to harden well before using, and another, I use one substance only for cell and fixing—no gold size or finishing varnish or other material. For dry mounts Brunswick black seems to me a very convenient and useful cement. It can easily be made the precise consistence required, and must not be too thin for fixing covers. W. E. Green.

88.—Extracting Sting of Bee.—Passing down Great Yarmouth market-place a few days ago I saw large swarms of bees on the sweet-stalls, the proprietors of which caught them by hundreds in their liquid "fly traps," so I have a plentiful supply, *all of which were dead when received.* I place my insects as soon as possible into a rather strong solution of acetic acid, where they will keep in good condition for a long time. After being immersed in the acid for some three or four days, I take an insect out and place it on a glass slip back downwards. I then take two quills (the same as used for pens, only not split and with very broad points, say the one-sixteenth of an inch); with one of these I hold the bee firmly down and with the other I very carefully slit open the last two segments of the abdomen, where, if the subject is a "*worker*," the sting will be found, and with careful and delicate handling the

sting can be drawn out with the poison-bag attached, The object should be placed at once into some clean water and thoroughly but carefully brushed with a camel hair pencil and placed under the microscope to see if it is free from surrounding tissues ; if not, it should be again washed, and if possible this work should be done under a dissecting microscope to get the best results. Having cleaned the specimen by further washing in pure water, it should be lifted into a drop of good carmine staining fluid, where it may remain for two or three hours, then washed to take out the superfluous stain, placed on a piece of absorbent paper (not blotting paper) for a moment, to take out as much water as possible, and then put into a small vessel (watch-glass) containing some good carbolic acid, and when the specimen is perfectly clear it can be immediately mounted in balsam and benzole.

If the above instructions are attended to, very good results can be achieved resulting in beautiful and instructive additions to the cabinet. I do not use methylated spirit with delicate insect tissues, as it hardens the parts and they are more difficult to manage. The tongue of bee may be mounted in the same way, but should not be stained. H. E. HURRELL.

103.—To Sharpen Razors.—The simplest method of sharpening a razor is to put it for half an hour in water, to which has been added one-twentieth of its weight of (H.Cl.) hydrochloric acid and water (which is muriatic acid), or sulphuric acid, then lightly wipe after a few hours ; set it on a hone. The acid here supplies the place of a whetstone, by corroding the whole surface uniformly, so that nothing further than a good polish is necessary. The process never injures good blades, while badly hardened ones are frequently improved by it. V. A. LATHAM, Manchester.

109.—Pictures of Leaves.—Perhaps the following method of taking impressions of leaves, which was communicated at a meeting of the Edinburgh Naturalists' Field Club, may be of use to those who wish to study the venation of leaves. Place the leaf on a piece of carbon or manifold paper, cover with a piece of common paper, and rub. Then place the leaf on a sheet of white paper, cover, and rub as before. I have another method, but it would take a great deal more space to enter into full particulars. There is a good article in the *Naturalists' World* (Aug., 1885).

V. A. L., Manchester.

109.—Pictures of Leaves.—The pictures referred to by "B." are done by photography, as he supposes. Arrange the leaves as you wish them to appear, get a piece of ready-sensitised paper, lay it on a flat surface, put on the leaves in the same order as previously arranged, cover with a sheet of glass, keep all in their place with weights or large drawing pins. Allow it to remain in a

light room until what is seen of the paper is black. Tone the paper in the usual way with gold chloride and fix with hyposulphate of soda. B.Sc., Plymouth.

111.—Hedgehogs.—I do not think it correct that hedgehogs cannot be poisoned. I once laid poison for some mice, composed of strychnine mixed with butter on bread; by some unlucky chance my pet hedgehog obtained one of the pieces and licked off the whole of the butter, with the result that death ensued soon after. Prussic acid acts by paralysing the nerve centres, and in that case one might (?) be led to suppose that hedgehogs did not possess them, and in that case they would be decidedly queer animals. V. A. L.

117.—Spots on Sycamore Leaves are caused by a fungus—*Rhytisma acerinum*, Fr. (Maple Rhytisma)—also named *Melasmia acerina*. In one stage it has been called *Xyloma acerina*. Of the species there are six British in the genus; one, *R. salicenum*, is common on willows. It has been found on both *Salix ripens* and *Salix nigricans*. If examined under the microscope (about 250 diameters) it will reveal the presence of ascospores and paraphyses, showing the black spots representing the incipient stage of the fungus *R. acerinum*.—(*Cook's Handbook of British Fungi*, p. 756.) V.

118.—Carbolic Acid and Cement.—Asphaltum seems not to be acted on by the acid; specimens so mounted three years ago are still sound. After treating the insect in a strong solution of carbolic acid to produce the effects on the chitine as seen by enquirer, they should be steeped in two per cent solution, then mount in the same solution and cement with asphaltum; the cell can, if necessary, be made of asphaltum. M. E. T., Macclesfield.

119.—Ringing Slides.—If the zinc white spreads when used for ringing, it is obviously too thin; buy some of the powder at a colourman's and mix it up with what you already have (by means of a knife on a slab of glass or slate) until it is of the necessary consistence; any small brush (camel hair or sable) will do.
B.Sc., Plymouth.

133.—Hæmatoxylin.—Kleinenberg's Hæmatoxylin is prepared in the following way:—

(1) Make a saturated solution of crystallised calcium chloride in 70 per cent. alcohol, and add alum to saturation.

(2) Make also a saturated solution of alum in 70 per cent. alcohol, and add 1 to 2 in the proportion of 1 part to 8.

(3) To the mixture of 1 and 2 add a *few* drops of a saturated solution of hæmatoxylin in absolute alcohol.

(4) It often happens that hæmatoxylin solution prepared in this way has not the proper purple tint, but is of a reddish hue. This is due to acidity of the materials used. The proper colour may be obtained by adding, *drop by drop*, a saturated solution of sodium bi-carbonate in 70 per cent. alcohol.

The tissue should be placed in alcohol before staining, and after staining transferred to 70 per cent. alcohol acidulated with nitric acid, in which it is left for a few minutes, and then placed in pure spirit. A. W. L.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their replies.

135.—Wasps.—Some sunflowers in my garden are much frequented by wasps. They seem to apply themselves mostly to the petioles and peduncles, and are seen occasionally traversing the veins on the underside of the leaves. No aphides are visible. The wasps seem to use their jaws on the hairs of the petiole and peduncle. Do the hairs exude a substance which they like?

A. L. W.

136.—Worms in Oranges.—A short time ago a young friend was eating an orange, and quite by chance had divided it. In the interior, the skin at the junction with the centre was all eaten away and contained about 18 or 20 small worms, very similar in size and shape to that known as "*Filaria sanguinis hominis.*" I was not able then to examine them more closely, and before I returned they died. Once before, but many years ago, I remember my sister saying she could not fancy oranges again, after having had a similar adventure which occurred about May. Can any reader inform me what worm it is, and if they have seen any similar cases? I believe it to be rare. A.

137.—Picro-carmine.—After staining sections in picro-carmine, what is the best and easiest method of fixing the yellow stain before clearing and mounting? J. J. A.

138.—Dessicator for Micro-objects.—What is the simplest and most satisfactory form of dessicator for preparing micro-objects which will not bear heat? M. E. Green.

139.—Jet.—Can anyone inform me whether it has been really decided what is the nature and origin of jet? A. B.

140.—Preserving Crustacea.—I should be much obliged if any of your readers could inform me how to preserve crustacea so as to keep the natural colour. T. D.

141.—Mounting Insects.—I shall be glad of any information which will enable me to mount for the microscope the head of a spider, fly, and similar objects, as an opaque preparation for reflected light, preserving, without contraction, the natural colours and appearance of the head and eyes. Also to know where the pure tin cells with caps or covers (of which I have heard or read) can be procured. J. W. B. L.

142.—Paradise Tree.—Can any reader say if there is a plant so called in Trinidad, and where we can find an account of it? We are told it cannot be moved, so it is not the bird orchid; that it dies down, or, as was expressed, "sinks to ashes every year." The blossom was described as "white, like a dove's head, with extended wings"! The party had only read of it. Can it be a traveller's tale? F. S.

143.—Cassia Oil.—Can anyone tell me how to seal mounts put up in cassia oil? The "pesky" stuff seems to fraternise with every cement I have yet used. A. L. W.

144.—Diatomaceous Material.—What diatomaceous material is most easily cleaned, and where found? D.

145.—Embryo of Chick.—What relation does the position of the embryo of the chick hold to the long axis of the shell?

In reading "Foster's and Balfour's Embryology," it says:—"If an egg be placed with its broad end to the right hand of the observer, the head of the embryo will in nearly all cases be found pointing away from him." In the second volume of Balfour's *Comparative Embryology*, page 146, the position of the embryo of the chick is defined thus:—"Its long axis is placed at right angles to that of the egg, and the broad end of the egg is on the left side of the embryo." Can these statements be reconciled; or which of them is to be accepted? V. A. LATHAM.

Correspondence.

[The Editor does not hold himself responsible for the opinions or statements of his correspondents.]

To the Editor of the "Scientific Enquirer."

SIR,—In "Science Gossip" for 1879 there appeared two papers

by Mr. Underhill on preparing and mounting entomological objects, and I have much pleasure in saying that the methods therein detailed have proved of great service to me. The directions were minute without being wordy, and on the first perusal, there was a precision which is so frequently wanting in papers written by practical men, who seem to fail in *impa. ting* to others modes of operation with which they themselves have been familiar for a longer or shorter time. I should like to ask Mr. Underhill, if he should see this, to accept my best thanks for his masterly papers.

And now, if I am not encroaching, I want to appeal to some kindly disposed practical hand at vegetable section cutting and staining. Will some competent amateur, who can afford the time and is willing to impart the information, write for us a similar paper on this department of practical microscopy, going through in detail the cutting, staining, and mounting—say, a section of stem of dog-rose ?

What I want, and what I hope some kind friend will volunteer, are simple instructions plainly given in the order of their occurrence, with the various operations, from the imbedding or otherwise fixing, down to the final placing in balsam. Another important item is the separation of the stages into (1st) those that *must follow on* with only the named interval between them, and (2nd) those that may be delayed to suit the convenience of the operator.

F. R. Brokenshire.

To the Editor of the "Scientific Enquirer."

The London Catalogue of British Plants.—Eighth Edition.

Sir,—The new edition of *The London Catalogue* has introduced so many changes both in the nomenclature and classification of plants, that the amateur botanist naturally seeks for some authoritative opinion upon the accuracy or otherwise of these changes. A great service will be done to amateurs if some professional botanists will only express their opinions. When such a well-known, and, as it seems to me, accurately named plant as the Perfoliate Yellow-wort, *Chlora perfoliata*, has been transformed into "*Blackstonia perfoliata*," one naturally asks for the reason and authority for such a change. I find this plant figured by Sowerby in the 1796 edition of "English Botany," and named *Chlora perfoliata*. On turning to the eighth edition of Professor Babington's Manual (which the editor of the *London Catalogue* refers to in his preface to the eighth edition), I find this plant described under its old name. Why this change of generic name ? If the worthy Editor of the *Scientific Enquirer* were suddenly to be styled Brown Alfred in place of Allen Alfred, I feel sure that many of his friends would object to the change : those who knew but little of him would be misled, and he himself might run the risk of doubting his own identity. The change of the generic name of a plant does not entail such serious consequences, but, to say the least of it, some substantial reason should be shown for a change which is certain to cause great inconvenience. What we want to know is, Are the many changes of generic and specific names in this new edition authoritative and justifiable? It is only fair to suppose that the editor has some good reason for the change ; what we ask for is, his authority. The name of the late Mr. H. C. Watson was a power in itself. The present editor may be as able a botanist as his predecessor, but he has the misfortune not to be, to me at least, so well known, and hence the enquiry. I do not wish to be captious or unreasonable. The *London Catalogue* is such a useful book to the botanist—in fact, I know no cheap book so useful—that amateurs naturally wish to be assured whether or not they are doing right in following the new edition. W. G. W.

Answers to Correspondents.

[All contributions should be addressed to the Editor of the *Scientific Enquirer*, 1, Cambridge Place, Bath, and not to the London Publishers. MSS. should be written on one side of the paper only, and signed for publication on the right-hand bottom corner. The full name and address of the writer should be placed at the left-hand corner, and when so placed, it will be understood that it is *not* to be published. Contributions SHOULD reach us before the 10th of the month, and cannot be inserted unless we receive them before the 14th.]

W. E. G.—By an oversight your query was omitted in our October issue. We shall be glad of your experience in mounting spiders.

A.—*Science Gossip* is published by Messrs. Chatto & Windus, London, and may be obtained of all booksellers.

B.Sc., Plymouth.—As a rule, the *Scientific Enquirer* is sent to London about the 25th of each month, and may be obtained through your bookseller of Messrs. Baillière, Tindall, & Cox, on the 27th. The October number was unusually late, in consequence of the fourth quarterly part of the *Journal of Microscopy*, with *Index*, being published at the same time. We trust the delay will not occur again. Copies ordered direct from the Editor are always despatched at the earliest possible date.

Contributions from the following are excluded in present issue for want of space:—A. B., J. G. P. Vereker., B.Sc., Plymouth, G. G. T., H. A. S., V. A. L., E. W., B. Lindsay, A. L., F. W. Steel, H. W. Lett, M.A., A. W. L., K. H. J.

Sale and Exchange Column.

What offers for Woodward's "Manual of Mollusca and Scientific Recreations"? Wanted, geological works.—G. E. East, Jun., 10, Basinghall St., London, E.C.

Spinnerets of Spiders, Stained, and mounted, without pressure, for other good mounts. Lists exchanged.—W. E. Green, 24, Triangle, Bristol.

Will exchange Nos. of "Chemist and Druggist" for 1880, or ditto of "Pharmaceutical Journal" for 1879, for "Ponds and Ditches," or "British Fungi," or similar works, or back Nos. of "Journal of Microscopy," or well-mounted slides.—H. W. Case, Cotham, Bristol.

Beautiful Plant Scales.—For leaves of the Sea Buckthorn (*Hippophæ rhamnoides*), covered with beautiful polarising scales, or for opaque objects; send stamped addressed envelope to H. E. Hurrell, 1, Church Plain, Great Yarmouth.

Worked Flints, Paleolithic and Neolithic, in exchange for Fossils.—Apply to J. French, Felstead, Essex.

Microscopical Slide Labels for Animal and Vegetable Kingdom, toned paper, 6d. per 100; samples of 33 kinds, 2d.—Chas. Watkins.

Insects in Spirit and Dry, selected for Mounting. New List ready.—Chas. Watkins, King's Mill House, Painswick, Gloucestershire.

High-class Injections from Monkey, consisting of lip, tongue, liver, lung, spleen, finger. The six slides for 5s.—Henry Vial, Crediton, Devon.

The Scientific Enquirer.

DECEMBER, 1886.

*The Study of a Few Common Plants.**

BY GEORGE L. GOODALE.

VIII.—THE FLOWER.

A FLOWER is a branch with leaves for the production of seeds. It is easy to find fault with every definition of so diversified a mechanism as a flower, but the definition just given will answer our present purpose very well. On page 123,† it is stated that, "since whatever springs from a bud is some sort of a branch, a flower developed from a flower-bud must be a branch too. And so it is. The helpful parts are here arranged in a very regular manner, and many of them are greatly changed in form and work."

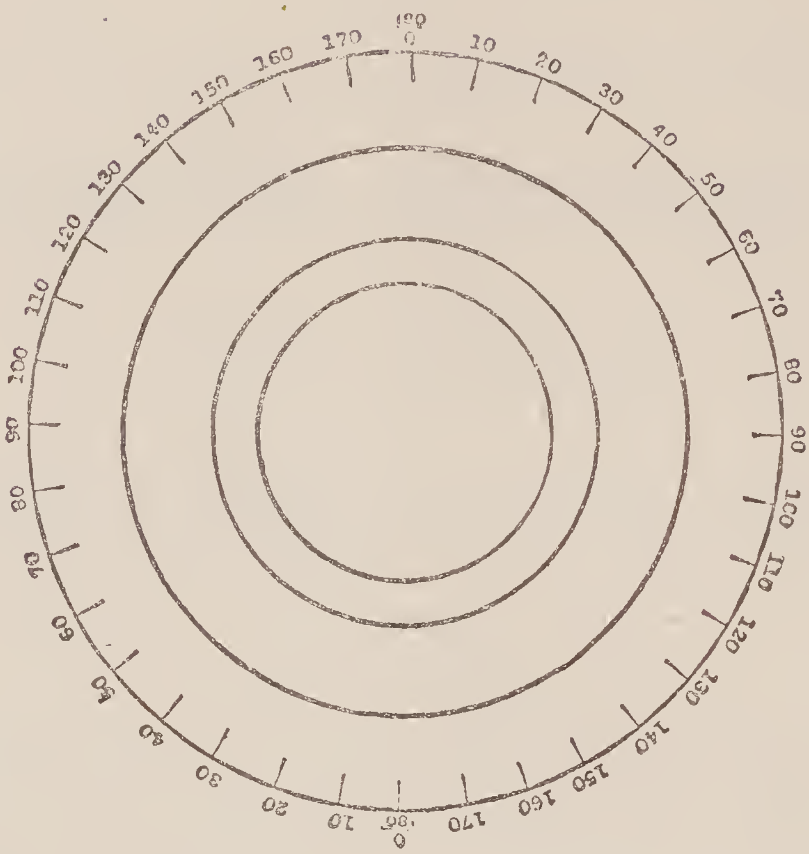
A blossom may be examined from many different points of view: of these, three will now be mentioned.

1. A flower may be regarded as a complicated mechanism made up of simple parts. Considered as a branch, a flower must be looked upon as a very short one, with the leaves crowded together into circles or into much depressed spirals. First of all, then, it is desirable to separate the parts of the crowded branch a little, so that their relations can be better seen. For this purpose, in ordinary cases, the diagram on next page will be found useful. Begin with a Crassula, or some good regular flower, and place each part of each circle of the blossom in its corresponding place in one of the circles of the diagram.

For instance, if the flower is on the plan of three, the parts of the outer circle (calyx) must be placed 120° apart; the parts of

* This series of papers is taken, with a few alterations to adapt it to the requirements of the English student, from one of a very useful set of books, entitled "Guides for Science Teaching," published by Messrs. Ginn, Heath, & Co., Boston, U.S.A.

† See *Scientific Enquirer*, No. 7.



the next circle (corolla) 120° from each other, alternating with the last; the stamens come next; and, lastly, the carpels, or the fruit-leaves (constituting the pistil); and the members of the circles will have definite relations to one another. On the plan of five, the parts in one circle will be 72° apart; on the plan of four, 90°.

Now, suppose we have a complete and regular flower with five members in each circle or whorl. Let the parts be separated, and placed in their proper order on the circles of the diagram, where they will again make up a complete and regular blossom. When this has been done, take away one of the stamens. Has it disturbed the relation of parts? Obviously not: *the place is left.* Next break a stamen in quarters, and replace one of these fragments. It lies in its proper place a mere vestige of a stamen, but the relations of the parts remain the same. What we have thus done with the dissected flower, Nature has done with very many. How to see what parts have been lost, or what remain only as traces, is a very interesting study. This study is much more difficult when the parts of one circle have become disproportionately enlarged on one side, or the parts of two circles have grown together more or less. To strip off these disguises, and detect the hidden symmetry of arrangement, is the attractive task of Morphology.

For this purpose, the simpler flowers, of large size, are preferable at first. Dog-tooth Violets (*Erythronium*), Lilies, Buttercups, Laurel (*Kalmia*), Single Pinks, and so on, are good to

begin with ; and these are to be dissected upon tablets, as above described, and as each part is removed it must go in its corresponding place. There is not an easier method of exhibiting the relations or position of the parts of flowers than the one here recommended. Whilst learning the names of the various parts of the flower—namely, sepals, petals, stamens, and carpels, the student should ask himself, and endeavour to answer the following questions :—

1. How many parts are there in each circle, and how are they arranged ?
2. How are the parts of the same circle united together ?
3. How are different circles united ?

The study of the flowers for the purpose of answering these questions will prove to be the best practice in observations which Botany affords. To indicate how exhaustive and how far-reaching these three inquiries are, we will apply them to a single illustrative case. 1. There are five sepals alternating with five petals ; five stamens opposite the petals, and none alternate with them ; more than one carpel, probably five, though the latter fact is hard to make out. 2. The five sepals are united more than midway ; the petals are united together, hence the corolla is monopetalous ; the stamens are separate ; the carpels are united to form a pistil with a single style and one-celled ovary with ovules in the centre. 3. The stamens are borne on the regular corolla ; the calyx, corolla, and ovary are all borne on the receptacle, and are distinct from each other. Now, apply this to any good Flora, or work on descriptive Botany, such as the Analytical Key of Dr. Gray's School and Field Book, or Hooker's Flora, etc., and it will be found that we can, without hesitation, place the flower under the following heads :— Flowering, Exogenous (plan of 5), Monopetalous, Calyx free from ovary, Corolla regular, stamens as many as the corolla-lobes, and opposite them, style only one, ovary one-celled, ovules many = Order *Primulaceæ*. The facts elicited by the questions have been gained by the student in an analysis like this by independent observation. If he reverses this process, and uses the key in the Botany to ask the questions by, he is adopting a method which tempts one constantly to look ahead to see how "the plant is coming out," as the phrase is.

If there is the slightest prepossession in the mind in regard to the probability as to which Order the plant belongs, this will influence the judgment about every point in the analytical key. It will lead, sooner or later, to a weak, careless, unfair, or even dishonest method of work. An analytical key is an artificial device at best—a sort of pick-lock, to save time. It may be used after, but not before, the three questions above spoken of have been answered ; certainly not *while* the questions are being answered.

To study a plant and its blossoms, from the point of view of Morphology, is a task of such interest and value for training that it cannot well be overrated. To thread one's way through the mazes of an analytical key, *before* the structure of the flower in hand has been thoroughly mastered, is to deal with a puzzle of little interest and of less profit.

Another method of arranging the answers to the questions proposed on the basis of Morphology was suggested by Professor Henslow, and embodied in Professoı Oliver's Elementary Botany. An illustration will suffice :—

Organs.	No.	Union of like Parts.	Union of different Circles.
Calyx *sepals*	5	gamo- or mono-sepalous	free from ovary.
Corolla *petals*	5	gamo- or mono-petalous	free.
Stamens	5	distinct	on corolla and opposite its segments.
Pistil *carpels*	5	united together	free from calyx.
Seeds	numerous, and on the axis.		

The blank schedule here filled out with the characters of the Order *Primulaceæ* consists of the upper line, denoting the value of the several columns, and the left-hand column, in which the organs are enumerated. The blanks may be constructed in any way that may be chosen, provided the answers to be written in filling them up bear upon the number and relations, as to position and union, of the parts of the circles of the flower.

2. The second point of view from which a flower may be examined is that of Physiology. A flower is a mechanism for the production of seeds. All parts, therefore, which are directly concerned in the production of seeds, must be taken into account. Even the floral leaves or bracts, which are only indirectly tributary to the formation of seeds, must be regarded. The outer circles, the calyx and corolla, are generally termed unessential, because they are frequently merely protective, while the stamens and the

carpels are the essential parts. The carpels contain the ovules, which are to become seeds; the stamens furnish the pollen, by the indirect action of which this change is to be brought about. Therefore, we might regard the ovules and the pollen as the only essential parts in the production of seeds. Each stamen consists of an anther, which is often supported upon a filament, or slender thread. "The anther is a sac filled with pollen, which most generally is like fine dust, but which is shown by the microscope to consist of minute grains of characteristic shape, size, and markings. The pistil is made up of one or more carpels, distinct or more or less completely blended together, and usually comprises three parts: (1) the ovary, holding the ovules; (2) the style, surmounting the ovary; and (3) the stigma, a point, or knob, or line of sticky surface at the side or summit of the style. The style may be wholly wanting. When the pollen acts upon the stigma, each grain may send down, after a time, a slender tube, which at last reaches an ovule. Here the contents of the tube act in some way upon the contents of a cell, or a group of cells, in the ovule, in which a new development begins, ending in the production of an embryo plant. The ripened ovule is a seed; the ripened ovary, with its contents, and often with some of its contiguous parts adherent, constitutes the fruit." It would seem, therefore, at first sight, as if flowers, in order to perfect seeds most readily, ought to be so constructed that the pollen can fall upon or reach the stigma without any difficulty. In some flowers, like the late and small flowers of our violets, and in a great many other cases, this is so: the pollen is placed by the anther directly upon the stigma, or the stamen is so placed that the pollen can very easily fall upon the stigma. But there are innumerable instances of just the opposite; and in these cases the transfer of the pollen must be made by the wind, by insects, or by some such agent. Some plants have the stamens only, while others of the same species have only the pistils. Willows are good examples of this kind of separation. Indian Corn is an example of a less complete separation. In this, the flowers with stamens form the plume above, and the pistils make up the ears with the silk (the styles and stigmas) below. The transfer of the pollen of Indian Corn is made by the wind, which can carry such dry dust to long distances. The pollen of some of our forest trees and shrubs is transferred by the same means, and it frequently falls by the way, collecting in large quantities on the leeward shores of lakes, where it resembles sulphur. There are many cases of separation of the stamens and pistil which are just as complete as Willow and Indian Corn, so far as the possibility of the pollen reaching the stigma without help is concerned; and yet the stamens and pistils are in the very same flower. For instance, in some orchids the

pollen is packed away in a little pocket, from which it cannot fail to reach the stigma, but from which it is readily detached by the insect which comes to the flower in search of nectar. The insect unconsciously carries the package of pollen off to another flower, and here it is brought in contact with the stigma of that flower. These are among the most striking cases of complicated mechanism by which an end is reached, and they can best be understood by a careful study of Professor Gray's charming treatise, "How Plants Behave," or Darwin's "Fertilization of Orchids." Without engravings, which cannot be employed in the present series of papers, their further description is undesirable. The object at present is merely to call attention to the interesting field opened before every observer of flowers. The transfer, in many cases, must be made by insect aid; but how can insects be made to work for something which does not concern them? There are many insects which are pollen-eaters. Such, coming to flowers for the pollen they get, might scatter more or less pollen around, and transfer some of it from one blossom to another; but there are more which are fond of the nectar of flowers. The nectar is for insects. It occurs in very diverse places in different blossoms, but it is almost always extensively and attractively advertised. Bright colours, with striking contrasts (the "nectar spot"), or with lines of contrasting colour converging towards the cup of nectar (the "nectar guides"), show the insect visitors where their food can be found. A little attention will make clear the meaning of many of the colours which otherwise might be passed by without thought. There is hardly any phase of applied Morphology and Physiology which is more interesting than the investigation of colour in flowers, and the insect visitors. Among the very striking features to be noticed in regard to the colours of flowers is the remarkable one that outside parts, the floral leaves or bracts, often share or even monopolise the brilliancy and attractiveness.

Odours are in general indicative of the presence of nectar. The relations of colour to fragrance, and both to the nectar which they advertise, will be found very attractive studies. A careful examination of the ways in which nectar is protected from injury by rain, will afford much interest to the student. The keen-sighted German, Sprengel, who at the close of the last century first called attention to the visits of insects to flowers in their search for food, observed especially the modes of nectar protection. One of these ways, described in his quaint language, is here spoken of. This case possesses much interest, for it appears to have been the one which earliest attracted him to this branch of investigation:—

"When, in the summer of 1787, I carefully examined the flower of Wood Geranium (*Geranium sylvaticum*), I discovered

that the lowest part of its petals was provided on the inner side and on both edges with fine, soft hairs. Convinced that the wise Author of nature has not made even a single hair without a definite design, I reflected upon the purpose which these hairs might serve. And it then occurred to me that if we suppose that the five drops of nectar, secreted from as many glands, are designed for the nourishment of certain insects, it might not be improbable that provision had been made to keep the nectar from injury by rain, and that these hairs are employed to attain this end. . . . Each drop of nectar rests on its gland immediately under the hairs which occur on the edges of two contiguous petals. Since the flower stands erect and is pretty large, it must catch rain-drops whenever it rains. But none of the drops which fall in can reach the nectar and mingle with it, for they are kept out by the hairs which cover it, just as the drops of perspiration which fall from the forehead are retained by the eye-brow and eye-lashes, and kept from getting into the eye. And yet an insect is not hindered in the slightest from reaching the nectar. I next examined other flowers, and found that they had something in their structure different from the first, but which seemed to answer the same purpose. The further I prosecuted this investigation, the more plainly I saw that those flowers which possess nectar are so constructed that, although insects can easily get to it, the rain cannot injure it. Thereupon, I concluded that the nectar of those flowers is secreted chiefly for the sake of insects, and is protected against the rain so that they can enjoy it pure and uninjured." *

Another very interesting branch of the study of plants will be found in the observation of that group of phenomena, known as the "sleep" and "waking" of plants. Flowers of some species of Oxalis exhibit this very well under cultivation, only in order to observe it the student must necessarily rise as early, or even a little earlier, than the flower. In some instances, the closing of flowers, which are to open again, appears to protect the pollen from night dampness. It may be here noted that those who can visit such gardens and wild fields as are accessible near a large city, might with a little pains ascertain what plants open and shut their blossoms at given hours, and what flowers close at the approach of bad weather. Facts like these possess a wonderful attractiveness for all who will take the trouble to ascertain them.

3. Flowers afford evidence of the degrees of kinship among the higher plants. The detection of the relationships belongs to Systematic Botany. Systematic botanists rely upon the degree of resemblance as indicative of the degree of relationship; but the

* Das Entdeckte Geheimniss der Natur, 1793, p. 2.

features which they take into consideration are not generally those which strike the eye at first. Therefore, a deeper search must be made; and the task is well adapted to a thoughtful student, guided by a suitable hand-book of the principles of classification.

Comparison of allied species is always useful, and well-executed drawings of plants can be turned to good account; but they should never be used to the exclusion of fresh specimens or well-preserved dried ones. Students should early commence to dry and preserve plants. The task is very simple, and collections are rapidly and easily made.

"In laying out the specimen for the press, use plenty of paper, so that their moisture may be quickly absorbed, and the danger of mould avoided. The specimens should be laid between the sheets of drying paper in as natural a position as may be, taking care not to crumple the leaves or flowers. If the specimens be too long for the paper, they may be carefully folded or cut in two. Delicate flowers should be carefully folded in paper when gathered, and kept flat. Do not arrange all the specimens just in the middle of the paper, but dispose them in such a way that, were a pile of them in their papers two feet high, they would not topple over: this will equalise the pressure. Several dry sheets ought to be laid between each layer of fresh specimens, the quantity of paper depending upon the thickness and succulence of the plants to be pressed. Pasteboards, or, better still, ventilators—made the size of the paper, of narrow strips of very thin pine wood (1-16 inch) at short distances apart, nailed together in two layers at right angles to each other—may be introduced at intervals between the layers of paper until the pile be ready for the press, which may consist simply of two stout boards, made so that they cannot bend or warp.

"Between these boards the paper and specimens must be placed, and a weight of stones or metal, not less than 50 or 60 lbs., laid upon the top.

"The papers should be changed several times once a day, and then at longer intervals, until the specimens are quite dry, when they should be removed from the press. If fresh specimens be placed in the press, while others are in process of drying, they must be carefully separated by pasteboard, or by a thick layer of paper.

"The length of time which specimens ought to remain in the press varies with their nature, whether dry or succulent, and with the kind and quantity of paper used." *

One of the most successful preparers of specimens of dried plants has frequently said to his friends that "specimens are made

* Professor Oliver's Elementary Botany, p. 288.

or spoiled in the first twenty-four hours;" that is, the papers should be frequently changed, or as often as they become damp, during the first day.

When dried specimens of flowers are carefully soaked in warm water, the parts become so softened that they may be readily dissected. It is just about as easy, though not quite so interesting, to study dried specimens thus soaked, as it is to study fresh ones. Even the hastily gathered specimens which one collects during a rapid journey, and thrusts for preservation between the pages of a book, can be soaked out, dissected, studied, and named at the first leisure.

[*To be continued.*]

Short Papers and Notes.

Development of Fleas.

Mr. George Harkus has succeeded in observing the whole process of the development of the flea from the laying of the egg up. He undertook to begin his experiment with two egg-laden females in a box, but the only result was a fierce battle that compelled separation of the two at once. Each individual laid a batch of from three to twenty-four eggs; the average was about a dozen, white and oval. Each end of the ova appeared, through the glass, to be surrounded by a spiral whorl of oval punctures, eighty at one end and forty at the other. The eggs were so nearly transparent that the whole process of development could be easily watched, and the exhibition, to judge from the warm terms in which it is described, must have been extremely interesting. The larva resembled elongated little worms, were destitute of feet, and kept up the usual wriggling motion of their kind. They absolutely refused to be fed, and usually died in a few days, so that very few chrysalides were obtained. Perhaps, if they had been given their natural way of feeding, whatever that may be, the success might have been better. Any exposure to cold or damp was immediately fatal. The larvæ, as the pupa stage is approached, assume a red hue, and, about eight days from hatching, spin a cocoon like a fluffy speck of white cotton. The threads are closely woven and of extreme tenuity, and when attached to a textile material of similar colour, must be difficult of detection. A cocoon was opened after the inmate had divested

itself of the pupa case, but still remained enveloped in a filmy, transparent integument. This pellicle covered the insect completely, following each leg and antenna continuously. About four weeks is required to metamorphose the speck of vitallised matter contained in the minute ovum of *Pulex irritans* into a suctorial tormentor.—*Popular Science Monthly.*

Flukes in Liver of Frog.

Very recently, on dissecting a frog, I found five fully-developed flukes in one of the lungs, identical in form with the sheep's fluke, besides plenty more in the egg-stage, which were quite blocking the lung. I should be glad to know if anyone else had found the same. I may add that sheep kept in the field from which the frog was taken had only suffered slightly from the disease.

J. William Gifford.

To Mount Spiders.

Few microscopists are aware how many beautiful and interesting slides are furnished by this family.

Dry-Mounted.

The eyes of spiders give most splendid and striking slides, as do the jaws when mounted for the paraboloid.

In Balsam.

To show well the fang and its perforation, the serratures on its inner edge, the lip, and the male and female palpi; the head should be treated with potash and mounted, without pressure, like similar insect preparations. The head of Tegenaria, with falces turned outward and fangs displayed, gives one of the most formidable sets of destructive apparatus to be seen through the tube. The palpi, too, may be shown well on the same slide in their natural position. To show the spinnerets well they must be cut off, and the upper and lower sets separated so as not to overlap when mounted. They should be very carefully boiled to clean, stained and mounted with little or no pressure; just enough to keep in position, I find, gives the best results.

In Fluid.

The silk glands are easily picked out after a day or two of maceration in liquor potassæ. The spinnerets must be cut off, but sufficiently high to bring with them the glands, transfer them to dilute acetic acid for a day or two, wash well to rid them of the acid stain, and mount in Goadby's fluid. The spiracles and pulmonary plates should be treated in the same way. The

former, however, show well if the abdomen be emptied, slit and spread flat on the slide, and put up in balsam.

If these few hints induce others to take up the study of these interesting and intelligent creatures, I shall be glad to hear through these columns of the results; they would be acceptable to many.

Much valuable information is contained in papers, by Mr. Underhill and others, in the volumes for 1874 and 1875, of *Science Gossip*. The accounts there given first led me to try my hand upon the Arachnoida family. W. E. GREEN.

To Polish Sea-Shells.

The surface of the shell should first be cleaned by rubbing it with a rag dipped in hydrochloric acid until the outer dull covering of the shell is removed. It must then be washed in warm water, dried in hot sawdust, and polished with chamois leather. Those shells, which are destitute of a natural polished surface, may be either varnished, or rubbed with a mixture of tripoli powder and turpentine, applied by means of a piece of wash-leather, after which fine tripoli should be used, and then a little olive oil rubbed in well, and finally the surface well rubbed with the chamois leather. The hands should be protected from contact with the acid.—*Decorator and Furnisher.*

Tongues of Snails, Slugs, etc.

On a still night the rasping sound of the snail's "tongue," as it operates on some strong leaf, may be distinctly heard. Professor Huxley calls these tongues "odontophores," or tooth-bearers. The odontophore is a "cartilaginous strap, which bears a long series of transversely disposed teeth." This strap is worked by controlling muscles, like a chain-saw, or rasp. Whether seen by polarised or ordinary light, the wonderful arrangement of the teeth of these odontophores invests their structure with a fascinating interest. The testacellar slug possesses a formidable rasp of this description, and that of the large garden slug, *Limax maximus*, is armed wth about 26,000 teeth.

V. A. L.

A Bee's Working Tools.

The working tools of a bee comprise a variety equal to that of the average mechanic. The foot of the common working bee

exhibit the combination of a basket, a brush, and a pair of pincers. The brush, the hairs of which are arranged in symmetrical rows, is only to be seen with the microscope. With this brush of fairy delicacy the bee brushes his velvet robe to remove the pollen dust with which it becomes loaded while sucking up the nectar. Another article, hollowed like a spoon, receives all the gleanings the insect carries to the hive.

A Freak of Nature.

Captain J. Buchan Telfer, R.N., writes from Spiez, Switzerland :—It may be of some interest to naturalists and others if I state that in the Hotel at St. Martin, Lantosque, in which I passed the summer of 1883, there was a creature, in colour pure white, having the head and forelegs of a cat, the hinder parts being those of a rabbit. The ears were likewise those of a rabbit. Its movements, somewhat laboured, were like a rabbit's, and when approached it would emit a discordant shriek. It was a remarkably timid animal, its sole and constant playmate being a young terrier, the only person in the house from whom it would not seek to escape being the cook. It was born of a cat on the premises, but nothing was known of the male parent.

H. W Case.

Depths of the South Pacific Ocean.

The Panama *Evening Telegram* reports that a line of soundings has been recently completed across the South Pacific Ocean from New Zealand to the Straits of Magellan, by Commander Barker, of the United States Navy. The greatest depth which was found is 3,002 fathoms near Chatham Island. This discovery is another disproof of the opinion so prevalent until the soundings of the *Challenger*, the *Tuscarora*, and *Gazelle* that the Pacific is a very shallow ocean. In the southern basin of the Pacific is an extended plateau bounded on the north by a line running through the islands of New Zealand, Friendly, Cook, Austral, Easter, and Juan Fernandez, the ridge of which these islands are the summits connecting with the coasts of Chili and Patagonia. The greatest general depression of this plateau below sea level, and the average depth of the ocean it encloses, is about 1,800 fathoms. Chatham Island, near which Commander Barker is reported to have found 3,000 fathoms, lies within three hundred miles of New Zealand. It would thus appear that the South Pacific basin very gradually rises from New Zealand towards the Patagonian coast. This is another evidence that the bed of the Pacific is more uniform,

with fewer abrupt changes of level, than that of the Atlantic—a fact which has some bearing upon the future of Pacific telegraph cable enterprises.

The Division of Climates.

Climates are usually divided, for convenient reference, into excessive, rigorous or continental, and uniform or insular. The interior of the Asiatic continent, and of that of North America, offer illustrations of the first; Great Britain and the Bermudas of the latter class. Over both the Asiatic and American interior, a desert belt extends, in general terms, at from thirty degrees to forty-five degrees north latitude. These deserts are, however, of much smaller extent on our continent, but are of similar character where cultivable. The climate of these interior districts is characterised by excessive heat in summer, and extreme cold in winter. In the interior of Tartary and of Southern Siberia the thermometer often stands for weeks together at eighty-six or eighty-eight degrees, while the mean winter temperature, during the coldest months, is as low as four degrees below zero. These extremes are parallelled in the interior of the American continent, within the United States. The equable character of an insular climate may be illustrated by the prevailing temperatures of the seasons in Southern Britain. In London, which is not, however, in the district most favourably situated to receive the best influences of the ocean, the inhabitants have but once or twice in twenty-five years an opportunity to comprehend the meaning of the term zero on Fahrenheit's scale, and ninety-seven degrees was only once in that long term felt.

Mushrooms.

These are grown in places built for their culture, in outbuildings, cellars, caves, or wherever a uniform temperature of between 50 and 60 degrees can be maintained. Cultivators vary much as to details. Some use pure horse droppings; others mix these with those of cattle. Beds are made of fermenting manure, built up solidly, and large enough to maintain a heat of about 70 degrees. Mushroom culture is conducted upon the largest scale in the vicinity of Paris, where there are extensive caves formed by the removal of building stone. These caves are from 20 to 60 feet deep, and of great extent. One of them contains sixteen miles of mushroom beds, and in another the beds in one year measured over twenty-one miles. As the plant does not require light, and as these caves have the requisite uniformity of temperature they are utilised by the mushroom cultivators. One

of the large cave owners in the season sends 3,000 pounds of mushrooms to the Paris markets.

Rock Salt.

In Lincoln County, Nev. (U.S.A.), on the Rio Virgin, there is a deposit of pure rock salt, which is exposed for a length of two miles, and a width of half-a-mile, and is of unknown depth. In places canons are cut through it to a depth of sixty feet. It is of ancient formation, being covered in some places by basaltic rock and volcanic tufa. The deposit has been traced on the surface for a distance of nine miles. It is so solid that it must be blasted like a rock, and so pure and transparent that print can be read through blocks of it a foot thick. At Sand Springs, Churchill County, there is a deposit of rock salt fifteen feet in depth, free from any particle of foreign substance, which can be quarried at the rate of five tons a day to the man. The great Humboldt salt-field is about fifteen miles long by six wide.—*The Manuf. Gaz.*

The Weeping Tree.

Those who wish to see this tree must go to the Canary Islands; it is there called the Fountain Tree; it lives in a constant shower. The water exuding from its foliage falls in a copious rain from its branches. One of them, of which there are three in the Island of Hiero, stands in the midst of a little pond that it perpetually supplies with water; hence the inhabitants in the vicinity go there to get their supplies. The tree is a reservoir, a manufactory, a laboratory. The one to which particular reference is made in the present instance is located on high ground, about five miles from the sea, and is venerated by the natives as a holy tree; its leaves constantly distil enough water to furnish drink to every living creature on the island. It is distinct from other trees, as it stands by itself. About nine feet in circumference and three in diameter; its branches overhang a circle of 120 feet around, and are thick and numerous. Its fruit resembles in shape that of the acorn, and tastes somewhat like the kernel of the pine-apple, but softer and more aromatic. The leaves are like those of the laurel, but are larger and wider, with a sharper curve; they come forth in perpetual succession, so that the tree is always green. On the north side of the trunk is a sort of natural double cistern, or tank of rough stone, each being about twenty feet square and ten or twelve in depth. One of them is used by the islanders, and the other by the cattle; a person is appointed to take care of it, and make a fair distribution of the water, and for this purpose is given house-rent free and a salary.—*Manuf. Gaz.*

Meteorites.

These have fallen at various times during the history of the world. One which fell in the province of Tucaman, in South America, weighs 30,000 pounds. It is situated in the midst of an extensive plain. A mass in the Imperial Cabinet, in Vienna, was brought from Agram, in Civatia, where it fell in 1751. It was seen by the inhabitants whilst falling from the air, and is said to have appeared like a globe of fire. Professor Pallas, in his travels in Siberia, found a mass in the mountains of Kemir, weighing 1,680 pounds, which the inhabitants told him fell from the sky. About 150 miles from Bahia, in Brazil, is a mass of crystalline texture, weighing 14,000 pounds. There is a specimen in a Cabinet, at New Haven, Ct., weighing 3,000 pounds, which was brought from the Red River Valley, in Louisiana. The largest meteor now known descended on a farm, in the township of Claysville, Pa., last summer. A number of weeks after the aerolite was seen to fall it was discovered by Professor Emerick, of William and Mary College. It was lying, when found, at the base of a high hill, and was deeply embedded in the soil, and almost concealed from view by the dead leaves the winds had blown over it. It required three men several days to unearth the monster. It had penetrated the earth until it came in contact with a stratum of limestone, when this sudden check of its fearful velocity caused it to break into many pieces of all sizes and shapes; yet when the earth was removed around it, it still preserved its original shape, so that the Professor was enabled to have a photograph made of it, and it only fell to pieces when the specimen-hunters found it. Its original weight was estimated at 200 tons.—*Manuf. Gaz.*

Answers to Queries.

43.—Dendritic Crystals are of common occurrence. A manual of mineralogy will enable you to compile a list of those occurring naturally. The most common instances are oxides of iron and of manganese, which form beautiful leaf-like deposits on flat surfaces of stone. Native metals are sometimes found in dendritic crystals; for example, copper and other metals crystallising in the cubic system. B. LINDSAY.

63.—Hydræ and Vorticellæ.—As "S." asks where in the neighbourhood of Manchester he can find these, let him start from Clarence Mills' Bridge, along the Ashton Canal, in the direction of

Guide Bridge. Hydra vulgaris occurs on the walls of the Canal, and on the loose stones near "Whitehead's" Twist Spinning Co.'s Mills. Its colour there is white (also Plumatella repens). After passing the last lock and crossing the bridge Riccia fluitans may be found (on the water-line). On the walls of the Canal many specimens of Vorticella, Epistylis, Carchesium, also V. microstoma, V. nebultifera, V. campanula, E. anastatica, E. grandis, E. digitalis, E. nultans, and the rare E. plicatus, C. polypinum, and C. spectabile; the foregoing has been found on the Riccia conferva near Park Parade Station. Upon the walls, near the bottom of the Canal, may be found Fredericella sultana, Stentor Mülleri, Trachelius ovum, Limnias ceratophylli, Collurinia imberbis, Vaginicola crystallina, V. valvata. I once found Ophrydium, on crossing the junction at Dutingfield, and the fresh-water sponge (Spongilla fluviatilis). Following the Canal, beyond Guide Bridge, nearing Stamford Colliery, and leaving the Canal, there is a footpath leading close to the pit-shaft, near to which are two ponds rich in microscopic life: Dinobryon sertularia, Chætophora elegans, Ophrydium versatile, Stentor polymorphus, with Desmids and Diatoms in abundance. Below the Snipe Inn, near the new railway, off Droylesden Road, there are a number of pits, which, taking them together, are the best in the neighbourhood. V. globator, Pandorina morum, Gonium pectorale, Draparnaldia glomerata, Batrachospermum, moniliforme, and Chætophora elegans. A species of Vaucheria is very abundant, upon which may be found Floscularia ornata, Cothurnia versatile, also Lophopus crystallinus, on floating timber and the submerged plants in some of the pits. The above notes may be of use to pond-hunters around Manchester. As for the best time of the year, spring and all through the summer they may generally be found. Sometimes the Canal has been dredged and cleared, and of course specimens are destroyed, or difficult to find. Mr. Bolton, of Birmingham, supplies the above at a nominal cost. V. A. Latham.

72.—Diatoms.—Deflagrate with potassium nitrate (saltpetre) in small quantities at a time. Sulphate of potassium and pure diatoms will be left. The sulphate can easily be washed away with water. E. B.

88.—Sting of Bee.—The simplest way is to boil the bee, and then pull off the head, which will be found attached to the sting, poison-bag, etc. E. W.

100.—Retina.—The received explanation with regard to the inversion of objects on the Retina is the one given in Huxley's Elementary Physiology, which you do not find satisfactory. With all due regard to received authority, it may be pointed out that

the special condition of the optic mechanism would suggest that some complex arrangement exists for correcting the inversion. The inversion of the Retinal layers, and the existence of the optic chiasma, are phenomena which as yet we do not fully understand; while the fact that the order of our perceptions *is* distinctly inverted in the case of the eye, is clearly shown by experiments on the blind spot, and on Purkinje's figures, which show the inner side of the retina on the outer side of the field of the eye. The subject is one worthy of further research, but it presents difficulties too great to be attacked except by an experienced physiologist. V. A. LATHAM.

101.—Series of Objectives.—My own experience would lead me to prefer a 2 in., $\frac{1}{2}$ in., and $\frac{1}{6}$ in. The aperture in each case to be the greatest consistent with the *best* chromatic and spherical corrections. If four or six objectives be allowed, I should recommend a $\frac{1}{2}$ in., $\frac{1}{4}$ in., or $\frac{1}{8}$ of 100° to 150° (air), and $\frac{1}{10}$. The last to be homogeneous immersion and wide angle. These last are the best for Histological and Pathological work.

B. A. L.

103.—Sharpening Knives for Section Cutting.—I use a fine hone, finishing on a razor strap, holding the knife close to the hone, so that the back touches. The knife needs sharpening oftener when used for vegetable sections than when cutting animal tissues, because of the presence in vegetables of a great abundance of crystals. L. M.

106.—Bile.—The bile pigments are the only constituents of the bile that can be suspected of being directly poured from the blood into the liver. Of these, Bilirubin, the reddish pigment, $C_{16}\,H_{18}\,N_2\,O_3$, is identical, in crystalline form and chemical composition, with hæmatoïdin, a yellowish substance found in old blood-clots, in microscopic rhombic crystals, first observed by Everard Home, but named by Virchow. The green pigment, Biliverdin, $C_{16}\,H_{18}\,N_2\,O_4$, is derived from this by further oxidation. That the bile, however, as a whole, may be regarded as a secretion of the hepatic cells, is indicated by the fact that no accumulation of bile in the body takes place when the liver is extirpated. It is, however, quite possible that the immediate chemical antecedents of bile may exist in the blood; in other words, it is possible that the function of the hepatic cells is not to initiate the series of chemical changes by which bile is formed, but to produce a comparatively small change by its action upon certain substances already waiting elimination from the blood. Thus the antecedent of the taurocholic acid of the bile, $C_{26}\,H_{45}\,NSO_7$.

$$\underset{\text{Cholalic Acid.}}{C_{24}\,H_{40}\,O_5} + \underset{\text{Taurin.}}{C_2\,H_7\,NO_3\,S} - \underset{\text{Water.}}{H_2\,O} = \underset{\text{Taurocholic Acid.}}{C_{26}\,H_{45}\,NO_7\,S},$$

is probably taurin, a normal constituent of some tissues. Cholesterin, again, exists as an "extractive" in tissue and in blood, and it is possible, though not proven, that the liver only collects it from the body at large, and does not secrete it. There are reasons, too, for supposing that the antecedent of glycocholic acid, $C_{26} H_{43} NO_6$—namely, glycin, $C_2 NH_5 O_2$—is at least potentially present in the body at large. Granting this, the function of the hepatic cells would consist in originating cholalic acid, $C_{24} H_{40} O_5$, and associating the various constituents of the bile; but even then, it would still be correct to say that, in the main, the bile is secreted by the liver. Glycogen resides *in the liver cells* (not simply in the hepatic blood), and is derived from (*a*) Amylaceous principles of food *chiefly*, since it exists in by far the greatest abundance after a saccharine diet.

$$\underset{\text{Sugar.}}{C_{66} H_{12} O_6} - \underset{\text{Water.}}{H_2 O} = \underset{\text{Glycogen.}}{C_6 H_{10} O_5}.$$

(*b*) The albuminous constituents of food, in small amount probably. [For further information see Landois and Stirling's "Physiology," Gamgee's "Physiological Chemistry of the Animal Body," and Foster's "Textbook of Physiology," 4th edition.]

V. A. L.

107.—Can a Vegetable Cell-wall Grow from Outside?—A cell-wall must be regarded as a protective secretion thrown off by the protoplasm; it can only grow by the activity of the latter, for it has no life in itself. Its growth in area can, therefore, only take place by intussusception beginning at the inner surface; in plain English, the cell-wall can only be let out by being *patched* from the inside. An *apparent* addition to the outside will take place when terminal growth occurs rapidly at one point, and the surrounding parts do not grow so fast; in this manner eminences are found, and appear as warts, knots, etc.; the prominences sometimes have a definite form and project into the interior of the cell; such are the annular and spiral thickenings. Sometimes an elongated pseudo-outgrowth is formed in the same way, by rapid growth along a line instead of along a point. This has been discussed by Hofmeister, in his "Handbuch der Physiol. Botanik." The "middle lameliac" of cell-walls in a tissue, which might at first sight appear like an addition, is merely the result of gradual differentiation of the cell-wall, in respect of density and chemical composition. V. A. L.

111.—Hedgehog.—We cannot regard living beings as consisting of fixed chemical compounds, always warranted to give the same results with the same reagent. Different animals may, even different individuals of the same species, or the same individual at different times, differ in the chemical conditions of their bodies.

The differences may be too small to be detected by analysis, but nevertheless we cannot doubt that they exist. For example, "one man's meat is another man's poison"; yet, although samples of the gastric juice of the two individuals may appear alike, the very fact that their digestive capabilities are different, proves indisputably that there is a difference in the gastric juice, although our present methods of analysis do not explain what it is. When it is considered that we are entirely ignorant of the exact composition of the molecule of protoplasm even, and of its mode of association with its accompanying salts and fats, it will be understood that we cannot dogmatise with regard to the effects of drugs in different cases. B. LINDSAY.

115.—Preserving Cartilage.—Drying spoils it. A hollow cartilage, such as a dog-fish's skull, may be stuffed with cotton-wool before drying, to preserve its shape. V. A. L.

123.—Resilvering Reflector.—"A. F." will find this a rather difficult task, and I would advise him to practice on other glasses first rather than his actual reflector. — Brashear's formula is reckoned by amateur astronomers to be the best. "A. F." will find it given in No. 794 of the "English Mechanic," and also some additional notes of Mr. Brashear on "Drying mirrors after silvering," in No. 1,025. To treat the subject fully would require too much space. B.Sc., Plymouth.

124.—Mushrooms.—There is no difference in the behaviour of the cultivated and wild mushrooms in their growth, but in the former case it is more observable and observed. What are known as mushrooms are really the fruit-bearing part of the plant, which itself consists of branched, slender, entangled, anastomosing, hyaline threads. In this state it is called spawn by the seedsmen, from whom lumps of it can be purchased for cultivating mushrooms in specially prepared beds. At certain points of the cobweb-like mycelium, the threads seem to be gathered in bundles, or heaps; these, by degrees, assume a small, nearly globular form, like a grain of cabbage or mustard seed. Afterwards this grows rapidly, and pushes its way through the soil, when it lengthens, and shortly expands into a mushroom. The tiny white globes can be found in any meadow that produces mushrooms, but as they are just below the surface they require to be carefully searched for. Whereas, when mushrooms are cultivated, the beds on which they are grown are kept in some house from which the light is excluded, the soil is very light, and there is no herbage for them to be lurking under, so some of the mushrooms appear as soon as ever they take upon them the pea-like shape, besides which the exact spot is known, and the owner is always on the watch for a gathering. Doubtless, mushroom growth is rapid, but

the variation, Miss Henty notices, is only seeming, and is due to the different conditions and surroundings which I have tried to explain. H. W. Lett, M.A.

128.--Photo-Lithographs.—All the known good processes are patented. If "S. B. D." wishes to get up the subject he should study the *British Journal of Photography* for the last three or four years. Specifications of all the patents have appeared there as they were issued. Since writing the above I learn that a practical manual has been issued on the subject. The author is W. T. Wilkinson, and the publishers are England Bros., London.

B.Sc., Plymouth.

129.—Object Glasses.—The difference in the focal length of the two lenses is probably due to the difference in their angular aperture, the lens which works the closer having the greater aperture, and being probably a better class of lens. The foreign lens is, most likely, composed of several achromatic combinations, giving a long working distance, but small resolving power. The terms $\frac{1}{2}$ in., $\frac{1}{4}$ in., etc., do not refer to the working distance of the objectives, but denote the magnifying power. Thus, a 1 in. objective, without the eye-piece, is of about the same magnifying power as a single lens of 1 in. focus, when used at a distance of 10 in. from the eye, and the other powers are in proportion. A $\frac{1}{2}$ in. of 90° works so close to the object as to require an adjustment to compensate for the thickness of the cover-glass. A. B.

129.—Object Glasses.—If the magnifying power is the same in each, then your friend has got a better $\frac{1}{4}$ in. object glass than you have. Probably it will have cost less than your English $\frac{1}{4}$ in., which is really one-eighth, although it has not got the magnifying power of that number, but only the restricted field of light pertaining to it. B.Sc., Plymouth.

132.—Magnifying Power of Objective.—"Amateur" should obtain a stage micrometer, ruled to hundredths and thousandths of an inch. He can then ascertain the magnifying power of each objective with each eye-piece, and make a table of powers for reference when drawing. The simplest plan I know of using the micrometer for powers up to quarter of an inch, is to focus one of the one-hundredth squares, and for higher powers one of the thousandth squares on the micrometer. Then, to place across the field of the microscope, at the *level of the stage*, a rule (ivory shows best), and keeping both eyes open, observe what space, on the rule, is occupied by the vision of the magnified micrometer square. It requires a little practice to make the objects coincide, but it is soon accomplished. It is evident that if the magnified one-hundredth fills an inch on the rule, the power is one hundred, and so on with the one-thousandth scale, and the higher powers.

A. B.

132.—Magnifying Power of Objective.—Place a glass micrometer divided into hundredths and thousandths of an inch on the stage, adjust the camera lucida, and have the drawing surface the same distance from the reflector as the latter is from the object-glass. Trace the magnified image of the scale on the paper, and measure it with a scale divided into tenths of an inch. Now, say each magnified one-hundredth of an inch covers one inch, the magnifying power will be one hundred diameters. A. W. L.

132.—Magnifying Power of Objective.—Suppose I wish to know how much a French quarter magnifies. The one-thousandth of an inch micrometer is placed in the field, and the magnified image is thrown by means of the neutral-tint glass reflector upon a scale divided into inches, and tenths of inches placed ten inches below the eye-piece. If the magnified one-thousandth inch covers about two-tenths of an inch, the glass magnifies two hundred diameters; if it covered one inch, the one-thousandth of an inch must have been magnified one thousand times, but in this case it only corresponds to the one-fifth inch; and, therefore, the one-thousandth is magnified two hundred times. It is very important for the observer to know the magnifying power of every lens with each different eye-piece, and he should ascertain this before he commences to make any observations.

To ascertain the Diameter of an Object.—If an object be substituted for the micrometer, and its outline carefully traced upon paper, its dimensions may, of course, be easily ascertained by comparison with the micrometer lines, the magnifying power used being the same in both cases. Scales are carefully drawn upon gummed paper, the magnifying power and the micrometer employed being written upon it. If a number are drawn together, one of the rows can be cut off and appended to the paper upon which the drawing, magnified in same degree, has been made. This is, I think, the best plan. V. A. L.

132.—Magnifying Power of Objective.—*Drawing.*—In *Science Gossip*, 1883, Sept., p. 193, there is a good paper on Microscopical Drawing. If a student desires to multiply his original sketches for the benefit of friends and others, a good way of doing so is by the electrical printing machine, by Waterlow and Co., the chief fault against the process being that the reproductions are in blue. The transfer lithographic paper, called the autographic paper, sold by Maclure, Macdonald, and Co., is very useful—that is, if he desires to have his drawings printed. When making a sketch of the object, the outline should be drawn with the aid of the camera lucida, and all the minuter details put in afterwards by a constant reference to the microscope. If possible, the objects should always be drawn to scale. To make this easier, the paper must

always be exactly ten inches from the camera lucida, an eye-piece micrometer used, and the lines thrown by this instrument on to the paper, noted, and a scale of the distance between each line marked for future reference. Scales of the different powers may easily be made by this plan, and will be found very useful. In drawings made by artificial light, two lamps should always be used, one near the mirror to illuminate the object, and the other close to the paper upon which the student is making the sketch.

V. A. L.

132.—Magnifying Power of Objective.—This is always calculated for an average of ten inches distance of vision, but is often given only approximately by opticians in their catalogues, apparently by the following method :—

Divide the length of the tube in inches by the nominal focal length of the objective, and multiply this by ten divided by the focal length of the eye-piece.

Thus, taking an English tube as ten inches long, a foreign one as six inches, and the "A" ocular as two-inch focus, a half-inch objective magnifies 100 diameters with an English tube, and 60 with a foreign tube. This method is very rough, but is sometimes useful.

An exact method of finding the magnification of an objective and eye-piece is the following :—Focus a stage micrometer, then bring the microscope to a horizontal position, and place a sheet of paper exactly ten inches under the centre of the eye-piece, remove the cap, and substitute a Beale's reflector, or a camera lucida, arrange the light so as to throw the image of the divisions on the paper. If your micrometer has a line passing tranversely through the divisions trace it, and mark about five or six of the divisions along it ; if not, draw a straight line along the paper, and make the divisions cut it at right angles as near as you can judge, the more exactly the better, and mark them off on it. Then measure them exactly ; let m. be the magnifying power, and assume that $\frac{5}{100}$ inch of the micrometer scale measures two inches on the paper ; then

$$\frac{5}{100} \times \mathrm{m} = 2 \quad \text{or} \quad \mathrm{m} = 40 \text{ diameters.}$$

In making camera lucida drawings the object is replaced by a stage micrometer, and the divisions are marked on the paper ; the same calculation will give the magnifying power. I always leave the divisions on the drawing as a scale.

J. G. P. Vereker.

133.—Hæmatoxylin.—In Vols. II., IV., V., of the *Journal of Microscopy*, "A. S. C." will find nearly all the various methods given.

V. A. L.

133.—Hæmatoxylin.—Boehmer's formula is—

Stock solution :—

Hæmatoxylin	40 grains
Absolute Alcohol ...	1 ounce

Working solution :—

Distilled Water ...	1 ounce
Alum	2 grains
Stock solution ...	a few drops

Keep a few days, and filter before using. B.Sc., Plymouth.

133.—Hæmatoxylin.—This is the colouring matter of logwood, but can be bought ready extracted. The following are two ways of making the stain :—

Dissolve 35 grains of Hæmatoxylin in 1,000 grains of water, and add about 20 to 30 drops of a solution of alum, 6 grs. alum to a fluid dram of water, to it to form a mordant.—By V. A. Paulsen. Or else—

(*a*) Prepare a saturated solution of crystallised calcic chloride in 70 per cent. alcohol, then add alum to saturation.

(*b*) Prepare a saturated solution of alum in 70 per cent. alcohol, add 1 volume of "a" to 8 of "b."

(*c*) To the mixture of "a" and "b" add a few drops of a saturated solution of pure hæmatoxylin in absolute alcohol ; filter. —By Professor Huxley.

The first receipt is for botanical work, and the second is a general one. J. G. P. VEREKER.

134.—Land and Fresh-Water Shells. — The dissection of mollusca is done under water. A common saucer is a convenient vessel. A dissecting trough is better ; and if the latter is used, the animal should be placed on the cork, and the head and forepart cut open, spread out, and firmly pinned down. The instruments required are a needle point, a fine-pointed pair of scissors, and small forceps—the points of the forceps should turn inwards. With the scissors cut away the tongue from its attachments, and soak in water for a couple of days, and then carefully cleanse it from all extraneous matter. It may be dried on a slip, and mounted as it is, or in canada balsam, as a polarising object ; or without drying, it may be mounted in preservative fluid. Whelks and limpets should be tried first. More care and skill is required with land and fresh-water snails, as in most kinds the palates are very small, and somewhat difficult to manipulate. A. B.

134.—Land and Fresh-Water Shells.—On bringing home specimens gathered, it is better to clean them at once. The animals are extracted after treatment with hot water. The shells should be assorted as to colours, species, and varieties, and mounted in pairs on small millboard tablets $2\frac{1}{2}$ inch by $1\frac{1}{4}$ inch, by

one-eighth inch thick, covered on one side with tinted paper for coloured, and steel blue or black paper for white shells. On label affixed to one end should be written genus, species, locality, and collector. I would recommend *Science Gossip*, Vol. 1883, January No., p. 6, which has illustrations, classification, etc. All the parts, more or less, have some very good articles. The *Journal of Conchology*, etc., may be of use. V. A. L.

135.—Wasps.—Wasps use the pubescence or hairs on the leaves and stems, for the purpose of constructing the combs of their nests; also the covering. I have at times observed them busy biting off and collecting the fluffy fibre that may often be seen on sawn, unplaned boards that have had a long exposure to the weather. Instances are recorded where they have made use of the coloured strips of paper hung on a string by a gardener for the purpose of keeping birds from his seed-beds, such nests being completely marbled by the pulp made from the different colours. Some *Apidæ* do the same, collecting from leaves, for it has interested me to see the female *Anthidium manicatum* collecting the pubescence from the Stachys and other wild plants, and flying off with its little bundle. J. S. W.

137.—Picro-Carmine.—It is said that sections stained in picro-carmine should be washed in picrate of ammonia to fix the colours, and I shall be glad to know where this chemical can be obtained, as I have often tried to get it, but in vain. H. E. H.

140.—Preserving Crustacea.—Mr. Edward Lovett gives the following plan in *Science Gossip*, 1882, p. 260:—"The plan that I have followed with considerable success in the preservation of some thousands of specimens of Crustacea is a remarkably simple one, and may be briefly described. In the first place, specimens of ½ inch or ¾ inch in diameter need not be dissected or cleaned out, but may be dried and set at once. Larger specimens should (if they be crabs) have the upper portion of the carapace carefully removed with a knife. In the case of the lobster forms, the thorax should be removed from the abdomen in the same way. Remove all the internal portions and wash thoroughly in cold, clean, fresh water. Should the carapace be a delicate or thin one, cotton wool may be inserted in order to assist in keeping the natural tint of the animal. Now replace the carapace and any of the limbs that it has been necessary to remove for cleaning (small claws need not be cleaned out), and fix by means of a strong, clean cement. Set the specimen up with pins on a piece of soft pine, arranging the limbs, etc., in order for the cabinet, and place the board of specimens in a cool, dark spot, where the process of drying will go on evenly. This is the real secret of success, as a little heat or light will soon bleach them.

Crustacea should be set up soon after death, and should be well washed in fresh water, or they will give in damp weather.

CHAS. WATKINS.

143.—Cassia Oil.—The only cement I have found capable of sealing mounts in Cassia oil is one made of shellac dissolved in methylated spirit, to which I add a few mastic tears to toughen the cement. When using this mounting medium, I find it best to let the freshly-mounted slide lie flat for a day or two. This allows the objects time to settle into position and the oil to spread itself just to the edge of the cover-glass. The ring of cement must be put on lightly and carefully. F. J. GEORGE.

144.—Diatomaceous Material.—There are two kinds of diatomaceous material: recent and fossil. In the former the minute plants are often found in an olive scum in shallow water, or forming a slimy coating on the submerged stems of other plants; this material can, with a little care, be gathered almost free from earthy matter, and is then easily cleansed by acids. The fossil diatoms are found in lacustrine deposits, in some instances of enormous extent and great thickness, and are always mixed with much earthy substance of an extremely fine consistence, which is troublesome to remove, but it is well worth the trouble. If "D" would like some I shall be happy to supply him.

H. W. LETT, M.A.

Queries.

[All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their replies.]

146.—Telescope Lenses.—How can I rid my telescope lenses of some brownish stains which have made their appearance, and after several washings of soap and water are not the least affected by it? The blotches seem like a fungus growth. A friend has the glass covering of a picture similarly blurred. Can such glass be chemically cleaned? F. W. M.

147.—Flocculent Matter in Diatoms.—What is the best method of eliminating flocculent matter from diatoms after boiling? G. G. T.

148.—Tortoise.—Can any readers inform me what a common land tortoise will eat? I have given it milk and lettuce, but it never appears to drink or eat either, and it will not eat raw meat.

K. H. J.

149.—Coccus Vitis-Viniferæ.—Can anyone inform me whether this Coccus (Linnæus), so accurately described in White's "Selborne" (letter 53 to Mr. Barrington), is of common occurrence in England now? White mentions it as being uncommon.

H. L. B.

150.—What Bird?—A bird nearly twice the size of house sparrow, head and upper part bluish; throat, breast, etc., reddish-brown, perhaps more correctly red. Note, a constant repetition of a sound resembling the words chee-wit, chee-wit. Station, generally upper parts of trees in the orchard.

E. H. R.

151.—Talc.—Will any reader of *Scientific Enquirer* tell me if Talc is used now in microscopy, and if so, what is it used for?

B. H.

152.—Continuous Observation of Micro-Fungi.—Will anyone kindly give me some information about observing the germination of fungus spores under the microscope? I have for some time been trying to experiment with various fungi, and cannot get the spores to germinate well—under a cover-glass, not at all. When uncovered some spores will send out filaments to a certain extent, but here the pabulum gets dry, and the process stops short.

G. H. L.

153.—Stomata in Fossil Plants.—Can any of your readers tell me where I can find any account of stomata having been observed in sections of fossil plants of any Palæozoic age?

C. L.

154.—Preserving Larvæ of Lepidoptera.—Can any reader inform me the best way to procure dried specimens of the above? I have a few autumn larvæ in spirits of wine at present. How should I proceed now?

C. S.

155.—Extracting Minute Snails.—Can anyone tell me how to extract the animal from very minute land-shells, and if there is any process that will absorb the animal without injury to the shell?

G. E. B.

156.—Chara and Nitella.—Will anyone tell me what is the best way to prepare and mount Chara and Nitella to show the *Antheridium*, *Carpogonium*, etc., and where in Lancashire they can be found, as I very much wish for a slide? What media is the best?

V. A. LATHAM.

157.—Crystals for the Polariscope.—I have been told that pure balsam would preserve crystals which would gradually dissolve

if the balsam contained turpentine. Perhaps someone will say if this is so, or whether gum dammar or copal would be a better preservative, for any method of micro preparation that is not permanent must be very unsatisfactory. I found that most of my preparations, after a time, lost all their sharpness and some dissolved away. J. W. N.

158.—Vegetable Ivory.—Querist would be glad of information about the perforation by insects of vegetable ivory, the nuts of *Phytelephas macrocarpa*, and whether there are any known means of guarding against these ravages. A specimen of nut and some insects were sent to me, the nut being bored in all directions, and rendered useless for manufacturing purposes. S. W., Hereford.

159.—Beetles' Burrows.—On turning over a stone which lay on the roadside, in the month of September, I noticed two holes in the ground, similar to those made by dor beetles under patches of cow and horse dung, and on digging into them I found in each a specimen of *Geotrupes stercorarius*. Perhaps some reader will kindly inform me whether these beetles are in the habit of making burrows under stones as well as beneath dung. R. W. GOULDING.

160.—Who is Right?—In the "Young Collector's Handbook to the Orders of Insects," by W. F. Kirby, the author, speaking of Humble Bees (*Bombus*), says—"There are no *neuters* among them, but the females differ very much in size, some being twice as large as others."

Referring to British Bees by W. E. Shuckard, page 310, we read—"They (the Bombi) consist of three sexes—males, females, and *neuters*."

Duncan, in his "Transformations of Insects," in referring to the cocoons of Humble Bees, at page 275, says—"They are of different dimensions. The smallest, always the most numerous, are the cocoons of *workers*."

Adam White, author of Part "Insects" "in the Museum of Natural History," in speaking of the Bombi, says—"The first nests which they construct are of small dimensions, only sufficient to contain a few cells, in which they rear the *workers*, who assist in the formation of the works necessary to the wants of a large colony."

Will some kind friend who has examined the reproductive organs of the Bombi say who is right? HUMBLE WORKER.

161.—To find Truffles.—Is there any way of finding truffles when you know they are growing in the neighbourhood, if you have neither dog nor pig to hunt them? DORA.

162.—Gall-Flies and their Parasites.—Will someone please refer me to a good, reliable, and recent work, in English, with

accurate figures of the commoner Gall-flies and their Parasites; also, a work or papers, with figures, of the commoner species of Saw-flies and Ichneumons? HUMBLE WORKER.

Correspondence.

[The Editor does not hold himself responsible for the opinions or statements of his correspondents.]

To the Editor of the "Scientific Enquirer."

SIR,—I am desirous of eliciting from the readers of the *Enquirer* as much information as may be available on the subject of the *continued observance of the minuter organisms under the higher powers.* This is a branch of microscopy which has especial interest for me. Often, after two or three hours' dissecting, washing, transferring, dehydrating, and several other "ings," ending in mounting, I reward myself by placing under the half inch a single drop of water from one of my several aquaria (small dinner-table bouquet-holders), which I know to be rich in organisms of various kinds, as a preliminary to the application of the quarter-inch, and finally an immersion 1—10 inch; and although there is, perhaps, in the field nothing which is *new* in the sense of not having been seen before a good many times, yet I invariably experience a pleasure arising from a new aspect or phase presented by some of the tiny occupants of the "drop" which, between the two glasses, is nothing more than a film so attenuated that in ordinary phrase they would be pronounced to be in actual contact. This film of water, however, affords ample accommodation to the myriads of living forms which people it, and even offers facilities for *diving*, which necessitates the constant use of the fine-adjustment, if it is desired to "keep an eye" on the movements of any particular inhabitant. Vibriones, Spirilla, Bacteria, Monads, Cyclidia, with an occasional Euglena, and many other forms, are there disporting themselves in what, for the time, is, to them, an ocean, and as one looks and wonders and tries to realise the actual, as against the apparent size, the nature of the forces represented by the various movements, the wonderful way in which the two kingdoms, animal and vegetable, gradually approach and eventually merge in each other, there inevitably arises in the interested and delighted observer an intense desire to continue the observation so long as may be necessary to see, on the part of some of the objects before him, developmental changes which would enable him to acquaint himself with, at any rate, *some* portion of the cycle, which, in its entirety, forms the life-history of the particular organism. It is here that I would solicit information of any kind from those who are in the habit of observing in this department of natural history. My own opportunities are not frequent, and I have no doubt that, with a little friendly tuition and a few hints as to manipulation, I should secure better results than at present. I am constantly finding and verifying animal and vegetable objects, and very interesting occupation it is; but I should much like, when I have, for instance, a number of Protococci, or a cluster of Palmoglœa cells, or a batch of Cyclidia, or a dozen Euglenæ, or any similar organisms on the stage, to be informed by any good-tempered, competent reader how to proceed, or what ength of continuous observation would be necessary to enable me to *witness* some of the transformations, the history of which, by so many writers, forms such delightful reading. I can quite see that a continuous supply of water of about the same temperature is a first necessity. How is this to be secured?

What half-dozen organisms from both kingdoms would be best to try one's "'prentice hand" on? Are there any changes of interest which a *day* would suffice for? and——. But these questions clearly indicate the kind of information which, coming from practical observers, would, I doubt not, be most interesting to many, and would certainly be highly prized by me. In concluding, I need hardly say that I am not ambitious enough to attempt any such wonderful work as that of Messrs. Dallinger and Drysdale with the Monads; and finally, that I feel no apology is necessary in connection with this communication, as I believe it to be in accordance with the spirit of our *Enquirer* and with our worthy Editor's desire that the *inexperienced*, in their difficulties, should apply to their more advanced brother microscopists, who are able and willing to assist them. F. R. B., Exeter.

To the Editor of the "Scientific Enquirer."

SIR,—The *Scientific Enquirer* has afforded much help to many interested in science, and the questions and information supplied by the answers have stimulated us in our work; but I believe these are only indications of a still more extended good which may spring from your labours.

I want to say a word on behalf of younger readers, which may indeed also apply to many older ones. Considering one branch only of the several departments of science—viz., microscopy—amateurs would accomplish much better work if, at the outset, they were guided in their choice of some particular line of study, instead of wandering aimlessly over such great fields as that subject affords. Could not some of your contributors give us a series of papers —one botanical, another zoological—containing hints for work, naming the special conditions under which the objects should be viewed, the points of interest to be noted, and their bearing upon other forms of life. With your consent, the names of those who would join in such a *method* of pursuit might be inserted in the journal, and any specially noteworthy results obtained might also be recorded. Such a union of amateurs would be productive of much good. Yours, etc., F. W. MORRISS,

Boston, Lincolnshire.

[Mr. Morriss's letter touches upon a very important subject—namely, the desirability in microscopical work (and, we would venture to add, in all scientific work) for beginners to take up some special line of study, instead of wandering in a desultory way over the vast field of science. As he has mentioned microsopical work, we will confine our remarks to that branch of research. Now, it must be remembered that in all microscopical work the first thing that a beginner must do is to learn thoroughly the use of the instrument he has in his hands. The microscope, like everything else, needs careful and repeated study, in order to make it thoroughly available. Its construction should be understood, facility in its manipulation must be acquired; above all, the various modes of illumination must be studied and become familiar, and in doing this the student must examine all objects that come in his way, not confining himself to any special class. Then it is only after all this has been done, and the use of the microscope fully obtained, that real work can be done. And in order to work really and throughly, the student ought to take up some one special branch which happens to interest him, and pursue that branch, so far as he can, into all its details. Thus, Entomology can be taken up, or Pond Life, or Parasitical Life; or, again, Botany, Sections of Plants, Organs of Plants, etc. The thorough investigation of some special subject will begin, and will become the real work of the student.—ED.]

To the Editor of the "Scientific Enquirer."

SIR,—I am much obliged to your correspondent, Mr. F. R. Brokenshire, for his letter in last month's *Scientific Enquirer*, as it enables me to say what I have wished for a long time to say with regard to the successful work of amateur microscopists. Mr. Brokenshire mentions some papers that appeared in *Science Gossip* in 1879 with reference to the preparation and mounting of entomological objects, and appeals to some "*practical hand*" to write a paper on the cutting, staining, and mounting of vegetable tissues.

Now, sir, although all right-thinking amateurs are at all times ready to impart any knowledge they may have gained in the thorny road of "experiments," I think it is hardly fair to ask them to give such detailed information as is asked for without a *quid pro quo*. Most amateurs who are adepts in one particular department of microscopical research, have not only devoted a large amount of time to their studies, but have also gone to considerable expense in getting at good results. Therefore, I think that, for the benefit of all concerned, before such a paper is written, promises should be obtained from the readers of your most interesting journal, from gentlemen who are willing to supply papers on some of the most interesting departments in practical microscopy. For instance, I would suggest that papers giving detailed information should be given on the following subjects :—

The Preparation and Mounting of Entomological Objects.
" " Insects without Pressure.
The Cutting, Staining, and Mounting of Histological specimens.
" " " Botanical specimens.
etc. etc.

I for one would be willing to undertake the task of writing a paper giving every requisite information on the last-named subject if others would promise to follow on in some or all of the subjects above-named and others, if possible. We should then have a series of papers fresh from laboratories of *actual workers* which would be helpful to all requiring information.

Yours truly, H. E. HURRELL.

The Distribution of the Lepidoptera in the British Isles.—As I am compiling notes for a work on this subject, I shall be very glad of any information and assistance which readers of the *Scientific Enquirer* can oblige me with. Local lists of Lepidoptera will be very acceptable.—W. HARCOURT BATH, The Limes, Sutton Coldfield, near Birmingham.

The Libellulidæ.—I shall be very glad to correspond with any persons who are pursuing this neglected branch of entomology with a view to exchange of notes and specimens. I am preparing a work entitled "A Monographic Synopsis of the Libellulidæ of the European Fauna," and shall be very glad fo the loan of specimens of dragon-flies for figuring.—W. HARCOURT BATH, The Limes, Sutton Coldfield, near Birmingham.

Reviews.

STORIES AND PICTURES of Beasts, Birds, and Fishes, and other Creatures. By James Weston. Illustrated by J. Giacomelli. W. Rainey, Harrison Weir, R. Kretchmer, and others. 4to, pp. 96. Paper boards, 1s.; cloth, 2s. (London: S. W. Partridge and Co. 1886.)

OUR FOUR-FOOTED FRIENDS. By Mary Howitt. Fourth edition, 4to, pp. 112. (London: S. W. Partridge and Co. 1886.)

Two most entertaining books, suitable as presents for young people. The stories are told in a charmingly interesting manner, and the pictures are well drawn. We have not for a long time met with two similar books which have pleased us more.

THE LUMINIFEROUS ÆTHER. By De Volson Wood, C.E., M.A. Pp. 129.

CHEMICAL PROBLEMS, with Brief Statements of the Principles Involved. By James C. Foye, A.M., Ph.D. Pp. 164.

THE FIGURE OF THE EARTH. Sec. I., Historical; Sec. II., The Oblate Spheroidal Hypothesis. By Frank C. Roberts, C.B. Pp. 95.

TOPOGRAPHICAL SURVEYING, including Topographical Surveying. By Geo. J. Specht, C.E. NEW METHODS IN TOPOGRAPHICAL SURVEYING. By Prof. A. S. Hardy. GEOMETRY OF POSITION APPLIED TO SURVEYING. By John B. MacMaster, C.E. CO-ORDINATE SURVEYING. By Henry F. Walleny, C.E. Pp. 210.

MODERN REPRODUCTIVE GRAPHIC PROCESSES. By Jas. S. Pettit. Pp. 127.

STADIA SURVEYING: The Theory of Stadia Measurements. By Arthur Winslow.

All 12mo. Pp. 148. (New York: D. Van Nostrand. 1884—6.)

A series of most useful little works, forming a part of Van Nostrand's Science Series. Many of them are well illustrated. That on Stadia Surveying contains a valuable table of Logarithmic Signs and Tangents. In the Chemical Problems the following plan is adopted:—After defining the terms used as far as is thought necessary, and briefly stating the principles to be illustrated, a typical problem is solved, and from the solution a formula of general application is deduced, which is followed by problems to be worked out by the student. These books will be found very useful to students in those particular departments of science.

THE BEE-KEEPER'S ALPHABET. (Bridgwater: J. Whitby and Son. London: Simpkin, Marshall, and Co.) Price 1s. A series of serio-comic lithographs, illustrating the various tools and appliances used in bee-keeping, with descriptive letterpress.

READ'S PATENT READY RECKONER, showing the Value of 1 to 50,000 Articles, at any given rate, from 1—16th of a Penny to a Pound, with Tables of Weights and Measures. (Newcastle-upon-Tyne: Sydney Read.)

This will be found by those who use this kind of book to be very efficient. It is printed on stout paper, and each page is indexed down the front for speedy reference.

Answers to Correspondents.

M. A. H.—We hope to find room for your query in an early issue.

A.—We will consider your query in a future number. Are not the new growths to which you refer seedlings?

E. S. Courroux.—Your valuable communications came too late for insertion in present issue.

F. S.—We should not have inserted your question, "Paradise Tree," if we had known that it had been asked and answered some time ago in a contemporary.

B.Sc., Plymouth.—Many thanks. We were obliged to go to press rather earlier this time.

Lester Francis.—We hope to find room for your contribution in our next. Many thanks for your letter.

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Hand-painted Lantern Slides of Micro Objects, also Micro Preparations, in exchange for named cabinet specimens of Diptera and Hymenoptera not in collection.—Chas. Watkins, Painswick, Gloucestershire.

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REVIEWS.

FEBRUARY, 1886. Vol. I., No. 1.

THE SCIENTIFIC ENQUIRER:

A MONTHLY MEDIUM FOR THE SUPPLY OF
INFORMATION ON ALL

Scientific Subjects.

EDITED BY

ALFRED ALLEN.

(Editor of "The Journal of Microscopy and Natural Science," and
Hon. Sec. of the Postal Microscopical Society.)

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Dear Sir,—

I send you herewith a copy of my new Journal, and trust, if you have not already ordered it, that you will do so now. I shall be glad also if you will furnish Queries, Answers, Short Notes, etc., all of which should reach me *at the above address* not later than the 10th of every month.

Contributions received later than the 14th of the month cannot appear in the next issue.

I am,

Faithfully yours,

Alfred Allen.

P.S.—In ordering, please say if you have received No. 1.

MARCH, 1886. Vol. I., No. 2.

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